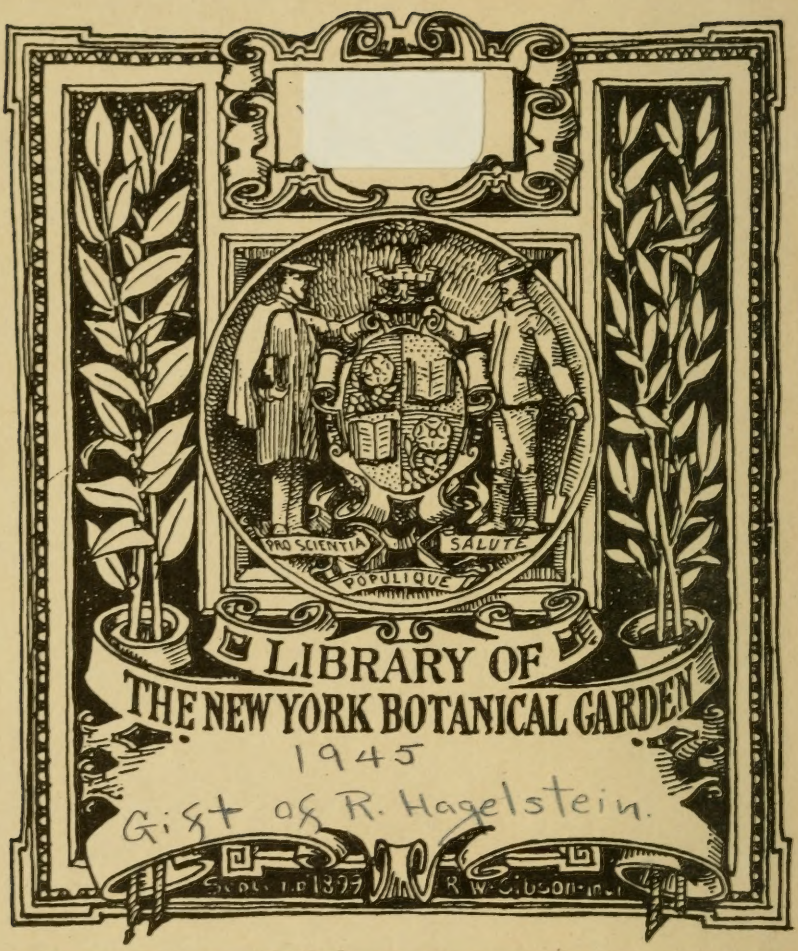
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THE MICROSCOPE.

AN ILLUSTRATED MONTHLY DESIGNED TO POPULARIZE THE SUBJECT OF MICROSCOPY.

Edited by

CHAS. W. SMILEY, A. M.

VOL. I, NEW SERIES. (NOS. 1-12).

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THE MICROSCOPE.

JANUARY,

1893.

NUMBER 1. (NEW SERIES.)

INTERPRETATION OF APPEARANCES UNDER THE MICROSCOPE.

BY PROF. S. H. GAGE,

ITHACA, N. Y.

[From *Microscope and Histology*, pp. 29–31.]

It is important to remember that the more of the relations of any object are known, the truer is the comprehension of the object. In microscopical investigation every object should be scrutinized from all sides and under all conditions in which it is likely to occur in nature and in microscopical investigation. It is best also to begin with objects of considerable size whose character is well known, to look at them carefully with the unaided eye so as to see them as wholes and in their natural setting. Then a low power is used, and so on step by step until the highest power available has been employed. One will in this way see less and less of the object as a whole, but every increase in magnification will give increased prominence to detail, detail which might be meaningless when taken alone and independent of the object as a whole. The pertinence of this advice will be appreciated when the student undertakes to solve the problems of histology; for, even after all the years of incessant labor spent in trying to make out the structure of man and the lower animals, many details are still in doubt, the same visual appearances being quite differently interpreted by eminent observers.

Dust or Cloudiness on the Ocular.—Employ the 18 mm. ($\frac{3}{4}$ in.) objective, low ocular, and fly's wing as object.

Unscrew the field-lens and put some particles of lint or dark cloth on its upper surface. Replace the field-lens and put the ocular in position. Light the field well and focus sharply. The image will be clear, but part of the field will be obscured by the irregular outline of the particles of lint. Move the object to make sure this appearance is not due to it.

Grasp the ocular by the milled ring, just above the tube of the microscope, and rotate it. The irregular object will rotate with

the ocular. Cloudiness or particles of dust on any part of the ocular may be detected in this way.

Dust or Cloudiness on the Objective.—Employ the same ocular and objective as before, and the fly's wing as object. Focus and light well, and observe carefully the appearance. Rub glycerin on one side of a slide near the end. Hold the clean side of this end close against the objective. The image will be obscured, and cannot be made clear by focusing. Then use a clean slide, and the image may be made clear by elevating the body slightly. The obscurity produced in this way is like that caused by clouding the front-lens of the objective. Dust would make a dark patch on the image that would remain stationary while the object or ocular was moved.

If too small a diaphragm is employed, only the central part of the field will be illuminated, and around the small light circle will be seen a dark ring.

Relative Position of Objects or parts of the same object.—The general rule is that objects highest up come into focus *last* in focusing up, *first* in focusing down.

Objects Having Plane or Irregular Outlines.—As object use three printed letters mounted in stairs in Canada balsam. The first letter is placed directly upon the slide, and covered with a small piece of glass about as thick as a slide. The second letter is placed upon this and covered in like manner. The third letter is placed upon the second thick cover and covered with an ordinary cover-glass. The letters should be as near together as possible, but not overlapping. Employ the same ocular and objective as before.

Lower the tube till the objective almost touches the top letter, then look into the microscope, and slowly focus up. The lowest letter will first appear, and then, as it disappears, the middle one will appear, and so on. Focus down, and the top letter will first appear, then the middle one, etc. The relative position of objects is determined exactly in this way in practical work.

Transparent Objects Having Curved Outlines.—The success of these experiments will depend entirely upon the care and skill used in preparing the objects, in lighting, and in focusing.

Employ a 5 mm. (1-5 in.) or higher objective and a high ocular for all the experiments. It may be necessary to shade the object to get satisfactory results. When a diaphragm is used the opening should be small.

Air Bubbles.—Prepare these by placing a drop of thin mucilage on the centre of a slide and beating it with a scalpel blade until the mucilage looks milky from the inclusion of air bubbles. Put on a cover-glass but do not press it down.

Air Bubbles with Central Illumination.—Shade the object; and with the plane mirror, light the field with central light.

Search the preparation until an air bubble is found appearing about 1 mm. in diameter, get it into the centre of the field, and if the light is central the air bubble will appear with a wide, dark, circular margin and a small bright centre. If the bright spot is not in the centre, adjust the mirror until it is.

This is one of the simplest and surest methods of telling when the light is central or axial.

Focus both up and down, noting that in focusing up the central spot becomes very clear and the black ring very sharp. On elevating the body still more the centre becomes dim, and the whole bubble loses its sharpness of outline.

Air Bubbles with Oblique Illumination.—Remove the substage of the microscope, and all the diaphragms. Swing the mirror so that the rays may be sent very obliquely upon the object. The bright spot will appear no longer in the centre but on the side *away from* the mirror.

Oil Globules.—Prepare these by beating a small drop of clove oil with mucilage on a slide and covering as directed for air bubbles.

Oil Globules with Central Illumination.—Use the same diaphragm and light as above. Find an oil globule appearing about 1 mm. in diameter. If the light is central the bright spot will appear in the centre as with air. Focus up and down as with air, and note that the bright centre of the oil globule is clearest *last* in focusing up.

Oil Globules with Oblique Illumination.—Remove the substage, etc., as above, and swing the mirror to one side and light with oblique light. The bright spot will be eccentric, and will appear to be on the *same* side as the mirror.

Oil and Air Together.—Make a preparation exactly as described for air bubbles, and add at one edge a little of the mixture of oil and mucilage; cover and examine.

The substage need not be used in this experiment. Search the preparation until an air bubble and an oil globule, each about 1 mm. in diameter, are found in the same field of view. Light first with central light, and note that in focusing up the air bubble comes into focus first and that the central spot is smaller than that of the oil globule. Then, of course, the black ring will be wider in the air bubble than in the oil globule. Make the light oblique. The bright spot in the air bubble will move *away from* the mirror, while that in the oil globule will move *toward* it.

Air and Oil by Reflected Light.—Cover the diaphragm or mirror so that no transmitted light can reach the preparation, using the same preparation. The oil and air will appear like globes of silver on a dark ground. The part that was darkest in

each will be lightest, and the bright central spot will be somewhat dark.

Distinctness of Outline.—In refraction images this depends on the difference between the refractive power of a body and that of the medium which surrounds it. The oil and air were very distinct in outline, as each differed greatly in refractive power from the medium which surrounds them, the oil being more refractive than the mucilage, and the air less.

Place a fragment of a cover-glass on a clean slide, and cover it. The outline will be very distinct with the unaided eye. Use it as object and employ the 18 mm. ($\frac{3}{4}$ in.) objective and high ocular. Light with central light. The fragment will be outlined by a dark band. Put a drop of water at the edge of the cover-glass. It will run in and immerse the fragment. The outline will remain distinct, but the dark band will be somewhat narrower. Remove the cover-glass, wipe it dry, and wipe the fragment and slide dry also. Put a drop of 50% glycerin on the middle of the slide and mount the fragment of cover-glass in that. The dark contour will be much narrower than before.

Draw a solid glass rod out to a fine thread. Mount one piece in air, and the other in 50% glycerin. Put a cover-glass on each. Employ the same optical arrangement as before. Examine the one in air first. There will be seen a narrow, bright band, with a wide dark band on each side.

The one in glycerin will show a much wider bright central band, with the dark borders correspondingly narrow.

If the glass rod or any other object were mounted in a medium of the same color and refractive power, it could not be distinguished from the medium.

Study of Germinal Layers of Petromyzon.—Mr. S. Hatta hardened the eggs and larvæ of *Petromyzon* partly in Kleinenberg's picro-sulphuric acid, and partly in corrosive sublimate. A few larvæ were also killed in Flemming's solution. The sublimate specimens gave the best result. Picrocarmine was found to be the best staining agent, as, being a nuclear stain and not affecting the yolk granule, it made observation comparatively easy. —*Journal Coll. Sci. Imp. Univ. Japan*, v (*1892*).

Preparation of Vegetable Tissues.—Mr. A. Flatters, in the Transactions of the Manchester Microscopical Society, 1891, pp. 38–47, gives detailed instructions in the use of the microtome and the cutting of sections of vegetable tissues, the preparation of leaf and flower-buds, the mounting of celloidinized sections, and the staining of vegetable tissues with logwood and with borax-carmine and iodine-green. Formulæ are given for preparing Kleinenberg's hæmatoxylin, picrocarmine, borax-carmine, and glycerine-jelly.

PHOTOMICROGRAPHY.

By F. A. Rogers, M. D.,

WORCESTER, MASS.

Photomicrography is the art of photographing the enlarged image of a microscopical object. It is the opposite of microphotography, which consists of microscopical photographs or reduced images of large objects or pictures, and which have little, if any, value except as curiosities.

When the amateur landscape photographer makes up his estimate of the requisites to pursue his coveted line of experiments, he is at first met with the expense of a suitable lens, for upon this depends in a great measure his success, while in photomicrography the objective, with or without the ocular, supplies the lens needed. Any good objective will give a good photomicrograph if properly manipulated.

It is best to begin with a low power, say a one-inch or three-fourths-inch or even lower, and aim to secure a sharp negative with good contrasts and of medium size. Be content with moderate amplification and good definition. If greater amplification is desired use a higher power objective rather than use a higher ocular with a low-power objective. Sunlight is by far the best for this purpose, yet excellent work can be done with lamplight.

By employing the most simply constructed home-made apparatus and suiting the convenience of the operator, either by sunlight, preferably, or by employing a single-wick kerosene burner with the flame placed edgewise in the optical axis of the apparatus, the principles of photomicrography can be easily illustrated and beneficially employed.

Before attempting to pursue this art, several preliminaries should receive attention. A dark room is one of the needed conveniences, and unless work is to be done wholly at night it becomes a necessity. Some unoccupied, darkened room, ample closet, or even a corner of a rough room may be suitably arranged for the purpose. It should be light-tight, contain a small sink and have running water if possible, but a suspended pail provided with a few feet of rubber tubing with a nipper-tap attached will answer the purpose of a reservoir and piping, while a small tub with a shelf inserted or board across the top may economize the sink. The room should contain a small stand, and two or three shelves are very convenient.

The paraphernalia needed to work with are a ruby lantern; three trays—one for developing, one for fixing, and one for toning (they should be so marked that they may not get mixed); three graduates—one eight-ounce, one two-ounce, and a minim glass; a plate lifter; one printing frame; Omega paper; Omega toning

solution; one sheet of ferrotype plate; squegees; broad camel's-hair brush; plates; plate-holder; focusing glass; camera; a pair of scales suitable for weighing grains; card mounts; parlor paste; and negative varnish.

The following chemicals are needed: 1 lb. each of sulphite of sodium, carbonate of potassium, chrome alum, hyposulphite of sodium, and carbonate of sodium; one ounce each of sulphuric acid, bromide of potassium, caustic soda, pyrogallic acid, and hydrochinon.

Several other things, such as a drying rack, intensifier, etc., could be added with advantage. To those who are financially able I would say select a good serviceable camera with several kits and one arranged for manipulating the micrometer screw at the end. With this instrument different sized plates may be used, and there is a certain satisfaction in using an instrument with all the modern improvements, but equally good results may be obtained with far less expensive apparatus; in fact, good work may be done by any one with a little ingenuity, by constructing a camera to fit the plate-holder. The most convenient size is the 4 x 4 or 4 x 5 plate. Select a good plate-holder for the above sized plate and fit it light-tight by means of a narrow ledge to a board 5 x 6 inches, which has a circular hole three and one-half inches in diameter in the centre.

Make a paper cone of black sheathing paper, 18 inches long, three and one-half inches in diameter at one end and large enough at the other to admit the draw-tube of the stand or ocular. Tack it to the inside of the hole in the board and at a right angle to it. Fill up all the chinks with sealing-wax and paint the parts that might reflect light upon the plate a dull black and we have a serviceable camera at no expense except the time of making.

Make a small frame that shall fit the board in the place of the plate-holder, and which contains a piece of ground glass for focusing upon, and support the whole thing firmly and permanently upon one end of a base-board, about one foot wide and four feet long, at such a height that when the microscope is turned back at a right angle the upper end of the draw-tube may enter therein.

As will be inferred from the above, the proper position for the microscope is to incline the body at a right angle with the base, but this is rendered necessary only from the position of our improvised camera and for convenience in manipulating.

I have found Carbutt's special, quick as lightning, blue label, plates to be very well adapted to the needs of this work. I should recommend that one select a good plate, and not change unless for some good reason, as we soon learn the peculiarities of each kind, and thus are better fitted to meet with emergencies and conditions which another plate might not possess. And,

again, any one will learn after repeated trials the exposure necessary, being guided by the intensity of light upon the ground glass. This varies with different plates and is another reason why one kind of plate should be adhered to.

There seems to be a variety of opinion with regard to the use of an ocular. Personally I do not use the ordinary Huyghenian ocular in photomicrography except in focusing as hereafter illustrated. Oculars especially corrected for this work may be obtained, but unless one is at hand I have found it best to use only the objective, which, if a good one, will give good results. I am aware, however, that there are those who hold a different opinion upon this point.

Microscopical enlargements are often, though improperly, expressed in "times" when diameters are intended. It is evident that if an object one-thousandth of an inch in diameter be made to appear one inch in diameter it has been magnified one thousand diameters, while the area has been increased one million times.

A few words in regard to the object to be photographed may not be amiss here. As we always use light transmitted through the object, it is obvious that objects which produce the greatest contrast in lights and shadows are the best for our purpose. The picture, while possessing little or no perspective, may show a great amount of detail.

The coloring of the object is another important point to consider. Sections stained with brown, black, or Heidenhains' impregnation give finer results than those stained with picro-carmine or blue. The part of a section to be photographed should be carefully selected by direct examination. It should be thin enough to show the desired details plainly, and, if possible, the coloring should give a good contrast of lights and shadows.

For all objectives of less power than a one-fourth or one-fifth, if the object be illuminated by sunlight, I would not use a substage condenser, but for a one-fifth or higher power I would use it.

As has been said, sunlight is the best source of light; electricity and the magnesium light have been employed, but for the majority of workers they are not practicable. In using sunlight a heliostat is a luxury which most cannot afford, but it is a convenience which all who attempt photomicrography, using solar light, would appreciate. Evidently the light must be reflected, and a mirror mounted upon a support so that it can be readily turned in any direction is a very nice adjunct to the opposite end of our camera board.

This can be easily arranged as follows: Remove the mirror and support from the mirror-bar and make a clasp of a piece of brass three inches long, three-eighths of an inch wide, and one-fourth of an inch thick by turning up one-half inch on either end. In one end fit a small screw that will bear

against the rim of the mirror, and solder a small hook of brass or copper wire to either end of the clasp. This is to be fastened across the concave surface, diametrically opposite to the fork which holds the mirror, leaving the plane surface free to reflect the light. The centre of a rather stout wire eight inches long is to be fastened by clamp or string to the lower part of the mirror-fork in a direction opposite to the first clasp. Make a small hook on either end of the wire. Let the mirror, fork, base-piece and clasps attached be clamped in an upright position at such a height that the centre of the mirror shall be on a line with the optical axis of the other parts.

Now construct a wooden frame that shall hold a roller as follows: Let it be eight inches long and one inch wide and consist of a base-piece with an upright two inches long fastened to either end. The wooden roller is one inch in diameter, long enough to reach between the uprights, and arranged to revolve on its axis between the ends. By means of a screw fasten the frame at its centre to the base-board under the camera-cone in a handy position, so that it may be turned in a horizontal direction. Let a string run from the hook on one end of the first clasp through a small screw-eye under the mirror, around the roller twice, back through a screw-eye, and attach to the other end of the clasp. From either end of the frame that supports the roller extend a string to the end of the stout wire fastened to the mirror-fork. It is evident that any position of the mirror may now be obtained by manipulating the wooden frame and roller.

But the mirror attached to the microscope, though far less convenient than the above arrangement, may be made to answer the purpose, and, although a little intractable at first, one soon learns to guide the beam aright. The beam must pass through the optical axis of condenser, objective, microscope tube, and camera to produce the right results. If eccentric, the image will be improperly illuminated, or distorted. If no condenser is employed, a diaphragm should be substituted. The size of orifice can be determined by noting the best result of definition, especially in the periphery of the illuminated circle upon the ground glass. In using the condenser, rack it back and forth from the stage until the best result is obtained, or until the field is equally lighted in all parts, then shut off the extra light with a proper diaphragm, or preferably by using the iris diaphragm if it has one attached, until the definition is the best that can be attained. A little experience will enable one to arrange the condenser in the best position for obtaining a good, sharp negative.

[*To be continued.*]

AMERICAN SOCIETIES INTERESTED IN MICROSCOPY.

By Chas. W. Smiley,

WASHINGTON, D. C.

For two years past the editor of this periodical has been collecting statistics of American microscopy. Among the questions asked was this: "What societies in your vicinity give attention to microscopy?" Out of a large mass of replies the following list has been compiled. All of the more important societies are doubtless included, but in order to secure data for its absolute perfection a premium is now offered for each additional name of a society devoted wholly or in some reasonable degree to microscopy. The premium will be a nicely mounted slide, or a year's subscription to the *Microscope*, at the option of the person first furnishing the information.

Most scientific and medical societies listen to papers occasionally in which allusion is made to microscopical work, but in order that such societies be enumerated in this list it is necessary that they indicate in some way an especial interest in this subject. This may be shown by the possession of a collection of mounted slides, by a good collection of books on microscopy, by meetings being held for the especial benefit of microscopists, or by the formal declaration that microscopy is one of the objects of the formation of the society.

A marked copy of the issue containing this list will be sent to each society's secretary. Upon its receipt, he is earnestly requested to return to us answers (numbered to correspond) to the following questions. The desired information when published will be of mutual benefit to all.

1. In what year was the society organized?
2. In what year incorporated (if at all)?
3. Has it printed copies of its constitution for distribution?
4. What is the regular time for meetings?
5. How many members (specify active, honorary, etc.) has it?
6. What are the membership fees?
7. What microscopes and accessories does it own?
8. About how many mounts has it?
9. How many books, pamphlets, etc.? (Specify the most important.)
10. What is the average attendance at meetings?
11. How is an account of the meetings published?
12. Who are the president, secretary, and treasurer for 1893?
13. Add any other items of general interest and specify to what extent the society is devoted to other subjects than microscopy.

Provisional List of Fifty Societies.

United States.—American Society of Microscopists (migratory), W. H. Seaman, Sec'y, Washington, D. C.

California.—San Francisco Microscopical Society, San Francisco, Cal., Geo. Otis Mitchell, Sec'y.

Colorado.—Denver Microscopical Club, Denver, Colo.

Connecticut.—New Britain Scientific Association, New Britain, Conn., M. S. Wiard, Sec'y.

New Haven Microscopical Club, New Haven, Conn., Thos. G. Lee, M. D., Sec'y.

District of Columbia.—Washington Microscopical Society, Washington, D. C., L. M. Mooers, Sec'y.

Illinois.—Illinois State Microscopical Society, Chicago, Ill. Wm. Haskins, Sec'y, 81 Clark street.

Dixon Biological Society, Dixon, Ill., Ira W. Lewis, Sec'y.

Peoria Scientific Association, Peoria, Ill.

Kansas.—Sphinx Society, Atchison, Kans., Prof. E. B. Knerr, Sec'y.

Leavenworth Microscopical Society, Leavenworth, Kans., W. D. Bidwell, Sec'y.

Kentucky.—Louisville Microscopical Club, Louisville, Ky.

Maine.—Androscoggin Microscopical Society, Auburn, Me., C. E. Williams, M. D., Sec'y.

Natural History Society, Portland, Me., C. B. Fuller, Curator.

Massachusetts.—Taunton Microscopical Society, Taunton, Mass., Dr. F. A. Hubbard, Sec'y.

Natural History Society, Worcester, Mass.

Michigan.—Griffith Microscopical Society, Detroit, Mich.

Minnesota.—Northwestern Microscopical Society, St. Paul, Minn.

Missouri.—St. Louis Club of Microscopists, St. Louis, Mo., S. E. Barber, Sec'y.

St. Louis Microscopical Society, St. Louis, Mo.

Nebraska.—Lincoln Microscopical Club, Lincoln, Nebr., Roscoe Pound, Sec'y.

Omaha Microscopical Society, Omaha, Nebr., Dr. Wilkeson, Sec'y.

New Jersey.—Essex County Microscopical Society, East Orange, N. J.

New Jersey State Microscopical Society, New Brunswick, N. J., F. C. Van Dyck, Sec'y.

Natural History Society, Trenton, N. J.

New York.—Department of Microscopy, Brooklyn Institute, 200 Washington street, Brooklyn, N. Y., F. H. Hooper, Sec'y, 71 St. James Place, Brooklyn, N. Y.

Microscopical Club of the Buffalo Society of Natural History, Buffalo, N. Y., S. Hobart Dorr, Sec'y.

Naturalist's Field Club, Buffalo, N. Y., M. A. Fleming, Sec'y.

Buffalo Microscopical Club, Buffalo, N. Y., James W. Ward, Sec'y.

UpDeGraff Microscopical Section, Academy of Sciences, Elmira, N. Y.

Fredonia Microscopical and Natural Science Club, Fredonia, N. Y., Nelson G. Richmond, M. D., Sec'y.

Jamestown Microscopical Society, Jamestown, N. Y., S. W. Baker, Sec'y.

New York Microscopical Society, 64 Madison avenue, New York, J. L. Zabriskie, Flatbush, N. Y., Sec'y.

American Microscopical Society of New York City.

Nyack Society of Microscopists, Nyack, N. Y., Miss Edith Stillwell, Sec'y.

Academy of Sciences, Rochester, N. Y. (in the Botanical Section there are frequently microscopical exhibits), Frank C. Baker, Sec'y.

Microscopical Club of Central New York, Syracuse, N. Y., W. H. Olmsted, Sec'y.

Troy Scientific Association, Troy, N. Y.

Postal Microscopical Club, Troy, N. Y., Dr. S. G. Shanks, Sec'y.

Ohio.—Cleveland Microscopical Society, Cleveland, Ohio, R. Dayton, Sec'y.

Microscopical Section, Natural History Society, Cincinnati, Ohio.

Pennsylvania.—Biological and Microscopical Section, Academy of Natural Sciences, Philadelphia, Pa., H. Wingate, Sec'y.

West Chester Microscopical Society, West Chester, Pa., F. McClurg, Sec'y.

Lehigh Valley Microscopical Society, Easton, Pa., Edgar M. Green, M. D., Sec'y.

Iron City Microscopical Society, Pittsburg, Pa , Geo. H. Clapp, Sec'y.

Rhode Island.—Providence Franklin Society, Providence R. I., H. S. Hathaway, Sec'y.

Virginia.—Richmond Microscopical Society, Richmond, Va.

Canada.—Microscopical Section, Entomological Society of Ontario, London, Ont., J. Alston Moffatt, Sec'y.

Montreal Microscopical Society, Montreal, Canada, L. J. Skelton, Sec'y.

Victoria Natural History Society, Victoria, B. C., Dr. Newcombe Pres't.

Corrections and additions to the above list are requested, and will be published.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Photomicrography.—No branch of microscopy has made such rapid progress in the past few years as this, but there is a constant demand for information as to the best methods, and especially for inexpensive methods. The beau ideal is of course to secure methods which, at the same time, are simple and inexpensive.

There is presented in *The Microscope* for January and February an article, by Dr. F. A. Rogers, which will prove of much value to any who desire to learn the subject. The entire outfit will not cost more than ten dollars, exclusive of microscope, and the directions are so easily understood that a lad of sixteen years may learn to take good pictures, while microscopists with but little time to experiment may reach satisfactory results by trusting themselves entirely to Dr. Roger's guidance.

Answers to Queries.—It often happens that a reader could give a different answer or some interesting details concerning the queries and answers which we are publishing. We accordingly invite all our subscribers to send notes, criticisms, suggestions, and items suggested to their minds by the perusal of our Queries and Answers.

This year, for the purpose of stimulating thought, we shall publish questions unaccompanied by answers, and in the hope of receiving quite a number of different volunteer replies. Such as prove of interest will be published in *a succeeding* number of The Microscope.

PRACTICAL SUGGESTIONS.

Light.—The best light to use for microscopic work is daylight, and the best daylight comes from a uniform gray cloud. A pure blue sky does not give the fullest power to a high objective. Avoid quickly passing clouds and direct sunlight. Set the microscope six or eight feet from the window.

Arithmetical Microscopy.—The best book on the theory and mathematics of the microscpe is Naegeli and Schwendener's Microscope in Theory and Practice, an English edition of which has been published by Macmillan & Co., New York. Most of it is too abstruse for any but professional microscopists.

The Eyes.—A friend of ours recently forbid his son to use the microscope because the young man's eyes were not strong, and further injury was feared. But with care one may learn to use the eyes a large amount without injury. Do not use a microscope for an hour after eating, nor in the early morning. Alternate the use of the eyes and habituate both to the use of the tube. Always discontinue work when the eyes show signs of fatigue.

Injuries to the Microscope.—If chloride of calcium and nitric acid, fuming hydrocloric acid, etc., are placed, when heated, close to the microscope the lacquer will be injured thereby. Similarly, sulphureted hydrogen, volatile acids, chlorine, and many gases developed in chemical operations will attack the instrument. For many reasons the instrument should be kept under cover as much as possible.

Cutting.—Before cutting a section, moisten both the blade and the object in order to secure a smoother and more natural surface. Draw the knife as if it were a saw, and do not push it as if it were a chisel. Thin and troublesome objects may be allowed to solidify in gum or paraffin. They may sometimes be cut between elder-pith or cork.

Good Permanent Paste.—A strong paste that will keep for a year or longer may be made in this way: After dissolving one teaspoonful of alum in one quart of water, stir in as much flour as will give it the consistence of thick cream, being particular to break up the lumps; stir in as much powdered resin as will lie on a dime, and a half dozen cloves. Have on the fire a saucepan with a teacup of boiling water; pour the flour mixture into it, stirring well all the time. In a few minutes it will be of the consistence of porridge. Pour it into a jar, let it cool, and tie over, putting it into a cool place. When any is needed, take out a portion and soften with warm water. Its keeping qualities will be enhanced by the addition of five grains of hydronaphthol dissolved in a little alcohol.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

125. *How are permanent mounts of spider's web made ?—A. R.*

Make a thick ring of varnish on a slip; when dry, run a fresh coat of varnish over it; place the slide under a newly-made (clean) web and press it upward so some of the lines of the web will run across the varnish cell and be caught in the fresh varnish ring; set the slip aside, under cover, until the varnish is dry; add one or more coats of varnish to make a rather deep cell; cover as a dry mount. The web seems to relax somewhat and the beaded or circular lines will touch the glass and adhere if the cell is shallow. The beaded lines are best near the outer edge of the web. The beads are glutinous and will adhere and flatten against the glass weeks after the mount has been closed if the cell is not deep enough.

126. *Is the poison in cheese and ice cream a microscopic bacteria ?—G. H. B.*

This poison is probably the result of a slight putrefactive change, which is always caused by bacteria. The poison has been obtained as minute crystals, which will produce all the symptoms of cholera morbus when swallowed. The poison is volatile at the temperature of boiling water, and poisonous cheese may be eaten with impunity after being cooked. These crystals are called tyrotoxicon, meaning *cheese poison*, in Greek. See an abstract in *Am. Mo. Mic. Journal*, vol. vi, page 175.

127. *Is there any sharp distinction between fresh-water ana marine diatoms ?—W. S. B.*

This query was sent to this department several months ago and was referred to Prof. H. L. Smith, who has kindly furnished, in substance, the following information: There is no sharp distinction between fresh-water and marine diatoms. There is but one species of *Pleurosigmæ*, with diagonal striæ, occurring in purely fresh water (and it is also brackish and marine)—*P. delicatulum*. The *Grammatophora* do not occur in fresh water, still there are closely allied genera which do. If one finds *Nav. virides* or *N. major*, or *Stauroneis phœnicent*, or *S. acuta*, in a fossil mass, he may be sure that it is a fresh-water deposit. A *Triceratium* is good evidence of a marine deposit, "and yet

I have found the genus *Rhizoselenia*, hitherto only known as distinctively marine, represented by two well-marked species in our great lakes."

128. *What is the meaning of tactile hairs ?—E. W. M.*

They are the long bristle-like hairs growing on the upper lip of nocturnal animals, especially, as on cats, rats, etc. They have a peculiar and abundant network of blood-vessels at the roots, and under excitement the hairs stand out erect and are sensitive, so the slightest touch on the extremity of one of them is immediately felt by the animal. These hairs assist greatly in guiding these animals when running through dark and intricate passages.

SCIENCE—GOSSIP.

Yeasts and Bacteria of Natural and Artificial Wines.—MM. Schaffer and von Freudenreich have reported on the microorganisms existing in natural and artificial wines, and, considering the method of manufacturing and composition of these latter, the authors' results are not surprising.

Of the ten natural wines examined only one contained bacteria, and this one, from imperfect treatment, had always been cloudy. Wines which had been several years in bottle were sterile, containing neither yeast nor bacteria. Artificial wines contained numerous bacteria, and the authors throw out the suggestion that the presence of these bacteria may have some connection with gastric disorders.—*Jour. Royal Micr. Society, August, 1892.*

New Method for Finding Tubercle Bacilli in Sputum.—Herr Dahmen has devised a modification of Bidert's method, the principle of which consists in separating the solid from the liquid portion of the sputum by boiling with caustic soda.

The author states that the same result may be arrived at by heating the sputum for fifteen minutes in a vapor bath. The solid particles almost immediately fall to the bottom and, after the liquid portion has been poured off, are well mixed up in a mortar and are ready for examination.—*Jour. Royal Micr. Soc., Oct., 1892.*

Staining Fibrin.—M. Sabouraud communicates in the Annales Inst. Pasteur, 1892, p. 184, a method for staining fibrin which is said to be superior to that of Weigert. Pieces of chancre fixed in Müller's fluid are placed for 15–20 hours in the following solution: Tannin $\frac{1}{20}$, alcohol 10 ccm. to 200 of the solution; they are then stained with anilin-violet (Ehrlich) and then colored by the Gram-Weigert method, in which during decoloration clove oil is substituted for analin oil.

RECENT PUBLICATIONS.

Domestic Science.—By James E. Talmage, Ph. D., Salt Lake City, Utah. Pp. 331, 93 cuts.

The perusal of this little hand-book, which the author says that he has designed for a school text-book as well as for general reading, has interested us very much. The author, who is a chemist, and well posted in physiology and physics, has treated some practical subjects of every-day life in a way to interest and instruct the young people of Utah. The policy of putting scientific truth into plain and simple language has been adhered to by Dr. Talmage without marring the dignity of science. The young people from thirteen to seventeen years of age who are not fortunate enough to go to college will derive very great and practical benefit for the duties of life by the study of such a book. This will appear from the following partial enumeration of topics: Air, ventilation, heating, lighting, the character and uses of water, the nature of food, and the chemistry of cooking, cleansing agents, poisons and their antidotes. The author has not in all cases put forward the latest claims of investigators on these topics, but has contented himself with setting forth the well-established facts.

The book was designed for strictly sectarian use. The authorities of the Church of Latter-day Saints, commonly known as the Mormon Church, have endorsed the book as being "imbued throughout with the spirit of our religion." We are glad to say, however, that the book is not very seriously tinctured with religion. The rainbow is declared to be "the seal of the covenant of the Creator with his children." The Great Creator, the All-seeing One, God's laws, etc., are alluded to repeatedly, but without sectarian bias. The book of Mormon is cited to substantiate the author's declaration that animal food can be used to excess, while strict vegetarianism is equally unphysiological. To our mind the book would lose nothing and gain much by the omission of these few religious touches. A book of science should not be used to inculcate incidentally views of government, sociology, language or religion. If the author will issue another edition, free from this objection, we shall take great pleasure in commending the book for use in certain schools throughout the entire country; for the central idea, of bringing within the grasp of all the people the practical and essential truths which science has taught us regarding every-day affairs, cannot be too highly commended. If a boy who is about to become a farmer, or a girl who is about to become a mechanic's wife, must choose between knowing grammar, arithmetic, or geography, and the scientific truths of this little book, the latter would be of infinitely more use in making life healthful and happy. If revised, as we have suggested, the index should be made strictly alphabetical.

List of Walter White's Botanical Sections and Other Objects Ready for Mounting or for Examination.

By CHAS. W. SMILEY,
WASHINGTON D. C.

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In many cases these objects have been stained, either singly or doubly, and some stained three years ago have not faded. Their very low cost commends them to every student of biology or collector of microscopic objects.

Directions for Mounting.—They may be mounted in resinous media (damar, benzol-balsam), glycerin, or glycerin jelly, the former being the easier for a beginner, while the latter, though more trouble, shows structure better.

In mounting, carefully separate the films, and remove the object. If for resinous media, soak in spirit of turpentine till clear, rinse in a fresh portion of the same, then drain, transfer to the slide, and finish as usual. For glycerin: If the object be oily, first wash out the oil with strong methylated spirit, transfer to glycerin and water, equal parts. Let it remain an hour or two, then mount. Minute objects, such as isolated cells, should be transferred on the point of a scalpel to a slide (or cover), and separated with a needle in a drop of spirit; then, if for glycerin, mount while still moist; but if for resinous media, allow to dry, then moisten with a drop of turpentine before applying the medium. Spiral and other vessels, and long fibre cells, which mat together, should be soaked in a drop of weak spirit, and a few of the most perfect picked out under a simple lens.

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PHOTOMICROGRAPHY.

By F. A. ROGERS, M. D.,

WORCESTER, MASS.

[*Continued from page 5.*]

The most particular step in the whole process of photomicrography, aside from lighting, is the focusing. We must not expect to focus "pretty good" and that the plate or developer will do the rest. If we expect to get a good sharp negative we must be sure that a good sharp image is projected upon the plate, for the plate will not lie, but will reproduce accurately the view which has impressed it.

The ground glass and plate must be in the same plane when they are exchanged; in other words, the sensitive side of the plate must occupy the identical place of the ground surface upon which the image is focused, in order that we may obtain a good negative. This becomes more important as work is attempted with higher powers, for then it is often difficult to determine when the object is just in focus; a magnifier or focusing glass now may be used with great advantage, but this magnifies the blurred and indistinct outline on the apparently much roughened surface of the ground glass. Instead of ground glass one may employ a negative which has been exposed to daylight and developed in the usual way, the film upon the surface being excellent to focus upon. Some coat the surface of the ground glass over with tallow or vaseline and claim that it improves it. But there is another method which is excellent for focusing high powers. Substitute a wooden slide for the ground glass, and let there be a hole or several holes in it large enough to receive the ocular. Have the slide of such a thickness that when the ocular is pushed in as far as it will go the diaphragm shall lie in the same plane as the surface of the ground glass. Insert it, and by this means the focusing of a one-fifteenth inch objective becomes an easy matter. This is a great improvement over the method of using a ground glass, or any other surface to focus a high power objective upon.

Before making an exposure there are several other points to observe.

1. A firm and steady support must be provided for our camera board to rest upon. No jarring is to be permitted during the exposure, as it will give a blurred image.

2. The heat rays should be intercepted by placing between the mirror and condenser, or mirror and object, a vessel with glass sides and filled with the following solution:

Sulphate of copper, . . .	175 parts.
Bichromate of potassium, . .	17 "
Water, ...	1,000 "

The vessel may be easily constructed from a pane of glass with a glass-cutter. It may be four inches square, and one-half inch between the glass sides.

3. Some means must be provided for exposing other than drawing the slide of the plate-holder, as it would disturb the adjustment. In using a low-power objective with long-working distance, a blackened card may conveniently be placed between the object and the objective, thus intercepting the rays while the slide of the plate-holder is withdrawn, when the card can be lifted long enough to make the exposure, and then replaced while the slide is returned in the plate-holder. Care should be exercised even here, as when the sun is shining directly upon the objective enough light may enter between the card and objective to spoil the negative. Of course no light must enter at the point where the draw-tube and camera are connected. But with an oil-immersion lens a different arrangement must be made, and I have found that a cardboard shutter in the end of the camera-cone, just in front of the end of the draw-tube where they are united, is very convenient.

We have been supposing, in the above description, that sunlight is to be used in our work, but if lamplight is to be used any convenient shade may be placed between the lamp and the condenser.

Let us now describe the several steps in taking a photomicrograph. We will first light the ruby lantern, enter the dark room, shut the door, unwrap a package of negatives, and, selecting one, we insert it, film side up, in the plate-holder. It should be carefully dusted with the broad camel's-hair brush and the slide inserted. With everything in readiness, with due attention paid to the lighting of a good microscopical object and perfect focusing of the image upon the ground glass, with the heat intercepter in place, and the shutter or cardboard properly arranged, we draw the slide from the plate-holder and make the exposure. How long shall it be? This is a perplexing question, because so much depends upon the plates we are using,

the object we are photographing, the objective in the experiment, and upon the illumination.

I would advise every one to keep a record of each and every trial, and be content if at first one good scientific negative is secured out of every half dozen used. I can do no better in answering the above question than to present the results of my experience gathered from a record like the one just recommended.

By using the camera I have described and with Carbutts' 4 x 5 keystone, blue label, lightning plates, the good results with the several objectives described below are given:

WITHOUT CONDENSER.

Leitz, No. 1, in sunlight, $\frac{1}{2}$ second; in lamplight, 5 seconds.

B. &. L., professional, three-fourths, in sunlight, 4 seconds; in lamplight, 20 seconds.

B. & L., student, one-half, in sunlight, 6 seconds; in lamplight, 30 seconds.

WITH CONDENSER.

B. & L., professional, one-fifth, in sunlight, 5 seconds; in lamplight, $1\frac{1}{2}$ minutes.

Leitz, No. 7, in sunlight, 10 seconds; in lamplight, 3 minutes.

Queen & Co., one-fifteenth, N. A. 1.30, in sunlight, 30 seconds; in lamplight, 10 minutes.

The lamplight negatives were all taken with the Acme lamp, using the bull's eye attached to the shade, and placed from eight to fourteen inches from the object, the mirror, of course, being turned aside.

The objects used in the above experiments were various, but consisted mostly of sections of animal and vegetable tissue, parts of insects, diatoms, blood corpuscles, bacteria, and the like.

After making the exposure the negative must be developed, and with every dozen, or half dozen, plates there are printed directions, which it is best to follow closely. The different manufacturers have formulæ which differ in some minor points, but these formulæ are best adapted to the several plates used.

Two principal developers are recommended, known as the *pyro* and *hydrochinon*. Equally good results may be obtained from the use of either of these, if the proper exposure has been made. The pyro develops quicker than the hydrochinon, but the latter can be used over and over again, while the pyro needs to be fresh. Personally, I have had the best results in photomicrography by using hydrochinon, and I would advise every one to try it. There is no danger of over-developing or fogging the picture, and it does not need to be so closely watched as the pyro developer. If a negative is suspected to have been over-

timed it can safely be started with the developer which has been used several times, and has thus become somewhat weakened.

We will now proceed to describe the several steps in developing the picture, using the hydrochinon developer.

The negative is removed from the plate-holder by the light of our ruby lantern only. A sufficient amount of the developer is poured over it in a small tray to cover the negative to the depth of about one-fourth inch. The tray should be rocked back and forth pretty constantly, and the image watched for its appearance. If the proper time has been given to it, the image will begin to appear in about three to five minutes (much sooner with pyro developer), and continue to develop until the details are all to be seen. If at this time we hold the negative up so that we may look through it, the picture will appear quite thin, and as the next bath fades it still more, were it now fixed we should have a very thin negative to print from. So we will return it to the hydrochinon bath, and leave it there until the image has apparently sunk quite out of sight or until upon close inspection in the tray only a faint outline of the high-lights is to be seen, then pour off the developer for future use, and after washing the negative several times in running water it is placed in the *hypo* bath or fixing solution.

At this time we may put another negative in the plate-holder and leave the dark room for a short time. Allow the negative to remain in the fixing bath for one or two minutes after it has cleared and then place in running water for an hour or in a pail of water for four or five hours, changing the water two or three times. It is then to be stood upon end and allowed to drain, becoming perfectly dry, when it may be flowed with varnish before we attempt to print from it.

I have used the sensitized albumen paper and toned the pictures with gold chloride, but the method, although producing excellent pictures, is somewhat lengthy and troublesome.

Many operators, not caring to go through with the process, send their negatives away for the printing and finishing of the picture. So for simplicity and good results I would recommend the Omega paper and Omega toning solution. With these any one can finish a fair picture in a short time and thus know the result of his labor immediately. Specify the size of negative in ordering and thus save the bother of cutting the paper. A one-pint bottle of the solution will tone and fix many prints, and the solution may be used over and over again until exhausted. The directions for printing and using the solution accompany the packages, so that it is not necessary for me to give them here.

I have refrained from giving formulæ for all of this work because the formulæ which I have found printed in works upon photography I have not followed, but I have used those only that

accompany the plates and other packages which I have purchased, and with the best of results.

Exposed to sunlight in a proper printing-frame, the film side of the negative in juxtaposition to the sensitive side of the paper, the latter soon becomes impressed by the negative, and when the print is a little darker than desired it is removed to a tray, where the Omega solution is poured over it. This both tones and fixes it. The print is next washed in water from one to three or four hours and the picture side is squeezed upon a polished sheet of hard rubber or a sheet of ferrotype plate and allowed to dry thoroughly, when it will fall off, leaving a beautiful glaze surface. It may now be trimmed and mounted upon cardboard if desired.

NEW APPARATUS FOR THE MICROSCOPE WHICH IS CHEAP, EFFICIENT, AND HOME-MADE.

By Arthur M. Edwards, M. D.,

NEWARK, N. J.

I am strongly in favor of cheap and efficient apparatus for the microscope, and when it is made by the microscopist himself it is doubly to be commended. The beginners, and for that matter some of the older microscopists, are not blessed with long pockets; and even if they were, economy is to be commended. I can remember the time, not so long ago, when I looked in the illustrated catalogue of some maker of microscopes and envied the possessor of some illuminator or lamp figured there. "Could they be made at home?" I thought. Objectives and oculars must of course be made in the shops, by expert opticians, but illuminators and lamps could be made by any one of ordinary capacity and some manual skill. I do not consider myself to be very skilful, but I do think I can try. Illuminators were the first things I made, and a half-inch plano-convex lens, costing not more than twenty-five cents, was the first. I described that in the *Quarterly Journal of Microscopy* for 1857, and it is efficient still with dry objectives, and even with immersion objectives.

I wish to describe an attachment to the lamp now, or rather a way of modifying the light of the lamp so as to use it with low powers and to render it actinic for high powers. In the *Microscope*, vol. xii, page 237, W. D. Grier mentions a cheap microscope lamp which is very good as far as it goes, and costs $2.15, but I think I can improve on it in the way of cost, and perhaps have it quite as good in quality. The lamp I have used cost 15 cents. I surround it almost with a roll of drawing-paper, but this can be done away with by using cheap white paper. If this

is thick it will stay rolled and you have an excellent shade which, by being white, reflects the light much better than a mirror. To make the modifier, I use a slide 3 inches by 1 inch, of ground glass, and this can be gotten very cheaply. If it is not ground fine enough it can be rendered more finely ground, and, in fact, I think it well to do so, by wetting always with glycerin, or it can be varnished with copal or other white varnish. I also coat another slide of ground glass with a varnish, copal or other white varnish, colored blue. It is colored with blue dye such as is sold for ten cents at the apothecaries. This is all. The lamp and the modifier do not cost 25 cents. That is cheap enough and I know it is efficient.

I now will describe a contrivance for centring and mounting microscopic objects. A brass slide is made of "brass rule" such as printers use for type. It is an inch wide, for that is the height of type and the width of the slide also. Cut it three inches long. The thickness does not matter much, but if as thick as a glass slide it will do. This has ruled on it with a steel point (the point of a file will do) two lines from corner to corner, cutting each other at the centre. This is the place where the cover is placed and this is, of course, immediately in the centre of the slide. An "American clothes-peg" is used to hold it over the source of heat. A slide is placed on the brass slip and is fixed there by the clothes-peg. It is then heated, and the brass, being a good conductor of heat, conveys all the heat over the whole slide, and we run no risk of breaking it. When it is heated enough with the object on the slide a drop of gum thus, which is the medium I use entirely, is placed on it. The alcohol is boiled off and the cover put in place. With this mounting apparatus we do away with the risk of overheating and so of breaking the slide, and as it retains the heat for some time the mounted object can be arranged very nicely. I use this little contrivance very commonly, and I hope that it will meet the wants of microscopists who mount objects themselves.

The cost of slides and covers is high. They can be made of a substance much cheaper, and possess properties which glass has not. In using celluloid, which is wood rendered soluble in ether and alcohol with gum camphor, for films for microphotography I was struck with some of its properties. It is transparent, unbreakable, light weight, and occupies very little room. It is strong as wood, has no fibre, and can be cut readily with scissors. It can be obtained with a ground surface as well as plain, and the cost is a trifle. Very thin celluloid films are used for instantaneous photographs, and this can be employed for both, whilst the thicker kind used for ordinary photography makes capital slides. I have some an inch square which I use in this way, mounting it temporarily in a glass slide for use on the microscope.

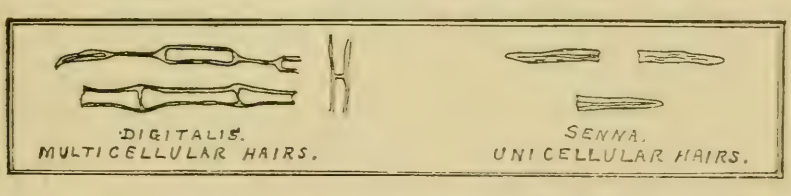
THE MICROSCOPE IN PHARMACY.—I.

By Prof. L. E. Sayre,

LAWRENCE, KANS.

It has been but a comparatively few years since the microscope was considered not much more than an expensive luxury or a mere toy. A few scientists who were peering into the invisible things of nature (whose work few could comprehend) were using it intelligently, but outside of this range of scientific workers few understood its value. What a debt we owe to the men of science who study it for its own sake, regardless of its practical applications! The microscope is an outgrowth of the scientific study of nature, and when we apply it in practice we are constantly reminded of the debt we owe the men of pure science for its existence.

We read a great deal to-day in current medical and pharmaceutical literature of the microscope in pharmacy, and this, however limited, is a sphere of usefulness and of much importance to the public. The pharmacist, if he be well informed as to all the recent methods of investigation, of the means of protection to himself and the public against adulterations, must know the value of this physical instrument. A branch of microscopic research especially interesting to pharmacists is the examination of powders.



Many drugs when reduced to a fine state of division lose all their physical characteristics and become unrecognizable to the ordinary vision. The microscope here proves a valuable assistant in the detection of the true nature of the object under investigation.

As an example of this, the cases of senna and digitalis might be mentioned. These two drugs in the powdered state resemble each other so closely that an ordinary examination reveals no appreciable difference in their appearance. Serious results have occurred from accidental substitution one for the other. But if they be subjected to microscopical examination, elements of difference may be easily discovered. Perhaps the best point of distinction is the hairs occurring upon the leaves. If a sample of powdered digitalis be appropriately mounted on a slide and examined under a one-fifth objective, numerous fragments of hairs will be found mixed with the debris. These, it will be noticed, are *multicellular*. Under the same conditions senna, on the contrary, exhibits *unicellular* hairs. Here, then, we have a ready,

convenient, and accurate method for establishing the identity of these powders.

This is but one example of numerous cases wherein the microscope would prove a valuable assistant to the pharmacist in his daily work, and he who has not the aid of a good microscope stands seriously in his own light.

Within the past few weeks I have had occasion to examine the market supply of buckwheat flour in the State of Kansas. The result of my investigations will be found in the report of the State board of agriculture. It is gratifying to know that there appears to be no mineral (earthy) adulterations in the flour. A microscopic examination reveals the fact that the two principal admixtures are wheat and corn flour, the former often in small proportion. In one case the flour examined contained so little buckwheat that the characteristic starch granules of that grain were scarcely visible. It appeared to be a mixture of corn and wheat flour, containing a small quantity of buckwheat.

MOUNTING LEAVES AND FLOWERS ENTIRE.

By Norman N. Mason,

PROVIDENCE, R. I.

In your issue of December, 1892, in reply to question No. 122, "Can leaves and flowers of small plants be mounted entire and show cells, &c.?" I notice that you have given a process which is exactly the one I was following with miserable want of success when Dr. J. G. Hunt, of Philadelphia, helped me out of my trouble by kindly sending to me the following very clear method:

"Soak your leaf or other colored parts of plants in alcohol to remove the chlorophyl, which is soluble in alcohol. If you do not soak too long you may retain and reveal all cell contents and granules. Then wash is water, and bleach in Labarraque's solution of chlorinated soda; chlorinated zinc is as good. When *white*, but *not corroded*, wash thoroughly with water till the soda is removed. *Don't use acid to neutralize.* Then immerse in potash alum solution; strength not important. The alum solution hardens the tissues and acts as a mordant for the color. Let them remain in the alum for two or three hours, then rinse in water. Now you are ready for staining. I prefer double tinting for some things.

"Take extract of logwood (hæmatoxylin) and potash alum, equal parts; pour on a little water and triturate thoroughly until a saturated violet-colored liquid results, and filter; do not add alcohol, for alcohol precipitates, as you will see presently. Take of this violet liquid one-half and glycerin one-half and mix them. This will keep and is the coloring fluid for best hæmatoxylin

staining vegetable tissues. But in this condition it is too strong for use; dilute until the specimen may be seen when immersed, and in a white dish. *Give ample time* for staining; here is the secret.

"Take next, or first if you like, aniline blue, and mix in water; strength not important. Make a solution of picric acid in alcohol, add a few drops of the picric acid solution to the solution of aniline blue until you develop a chlorophyl green; now soak in this liquid *a few hours, or a day*; perhaps it will stain some parts which hæmatoxylin will not—growing points, spores, crystoleths, stomata, etc. It is sometimes best to stain first in the green, then in the violet. Never allow your specimens to dry, and absolute alcohol is not needed. Now immerse in 95 per cent. alcohol to dehydrate. Alcohol precipitates the hæmatoxylin in the tissues, and extracts the excess of picric acid, and fixes a beautiful blue-green color just where nature likes it best, while the alum prevents structural change in the most delicate parts. You may keep specimens for weeks in this watery alcohol, and every cell wall will become more distinct until you find time to mount.

"Clarify the specimen in oil of cloves, thoroughly drain off all the superfluous oil of cloves (I lay the specimen on my hand; that soaks it up), then mount in Canada balsam."

I do not know how thick a leaf must be to be too thick to show clearly through the leaf the cells on the underside, but a mullen (*Thapsus verbascum*) will show each layer from the hairs on the top to the tips of the hairs on the underside *as clearly as if the cells were made of spun glass.*

Staining Vegetable Sections.—Having cut thin sections of any plant or stem, the specimen may be rendered more intelligible by staining it before mounting. Different dyes stain different parts of the structure and so make these parts seem more prominent. The contents of cells are also brought to view in this manner.

There are three kinds of effects produced by stains: (1) Some stains attack the nuclei and are called nuclear stains. These leave all but the nuclei uncolored. Hæmatoxylin and carmine are prominent nuclear stains. (2) Some stains color the ground substance and leave the nuclei uncolored, or color all the tissue uniformly. These are called plasmatic stains. The contrasts produced by coloring nuclei with carmine and the ground tissue with a stain, such as eosin, is very striking. (3) Specific stains color certain elements of the tissues only. For instance, liquefied tissues are stained with methyl green. Cellulose may be colored blue. Lignin may be colored yellow.

From these principles result double and even triple staining of the same specimens, but the process is tedious.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

What can a Beginner do in Microscopy?—There are a good many young people commencing to take an interest in botany, entomology, geology, ornithology, etc., who spend much time to little profit for lack of suitable guidance, oral or written. And there are teachers who feel too much tied to their text-books and so who cannot practically start their pupils in interesting work. There is an impression abroad that the members of the Agassiz Association lack direction, systematic and continuous application to single topics such as will yield desirable fruit. Collecting plants, insects, rocks, birds' eggs, etc., sometimes is followed by little more than identification.

At this point the microscope may be wisely brought into use, and we shall be happy to tell the young people of the Agassiz Association, as well as others, what to do next and how to do it. Each chapter of the Agassiz Association, if not each individual, ought to afford a $20 outfit in the way of microscope and accessories. If they will each then fix upon some topic such as is named below and pursue it, we shall be glad to provide, free of charge, all needed assistance.

As soon as we can get the illustrations and the descriptions of the instruments (March or April) we will set forth in much detail directions for purchasing an instrument, and will intercede with the dealers for the very lowest prices. You do not want one of the toy microscopes which can be bought for $3, because its powers are too limited, but you need one such as is pictured by several of our advertisers.

The following indispensable features for such a compound instrument have been named by Dr. Shanks in response to a question:

"A compound microscope should have a one-inch or C eyepiece, a joint for inclination. The mirror should swing above the stage so as to furnish a top illumination on opaque objects and a fine adjustment. The rack-and-pinion coarse adjustment is convenient but not necessary, if the cost must be kept low. There should be two object-glasses—a one-inch and a one-quarter inch. The one-inch glass will give good surface views of opaque objects and good general views of sections. The $\frac{1}{4}$-inch glass will magnify sufficiently, and is easier to use than the usual $\frac{1}{5}$-inch or $\frac{1}{6}$-inch objective. These latter glasses work very closely and require thin sections for their full utilization. The $\frac{1}{4}$-inch objective should resolve *P. angulatum*."

Topics for Study.—As to selection of topics for study, we are able to present the views of two different writers, both experts. Additional directions may be found in many books, some of the best and cheapest of which may be found listed among the advertisements. Dr. Shanks' advice is as follows:

"Buy this book: '1000 Objects for the Microscope,' by M. C. Cooke. It will cost 50 cents and will suggest the examination of many common objects to be found everywhere. As a suggestion for some lines of work that young people may do, the following will be within their abilities:

"Study the habits and food-plants of insects, especially those feeding on our vegetables and fruits. The insects may eat the leaves or the fruit, or bore into the bark or wood. Examine all parts of the plant for eggs, worms, or cocoons. Make collections of all of them. Hatch out some of the eggs. Also try to develop the cocoons or pupæ. Make notes of every circumstance, date, plant, etc. Do not try to do too much in one year. Select two or three plants for study. Reliable information in these lines will be gladly received by our State entomologists and botanists, who will cheerfully name any specimens sent them for identification. Make pressed and dried collections of the mosses in fruit. Make notes of the localities when found and date. Gather the catkins, etc., of willows and other trees that bloom early before the leaves appear. Gather the leaves later; then the fruit in early autumn. Put them together. Make notes of the different dates, etc.

"Grasses are easily gathered and easily pressed and dried, and the variety is greater than one would imagine. Make collections of the grasses—when in bloom—and also when the heads or spikes are in full seed. Note also the root, whether it is simply fibrous like an annual, or has an underground fleshy stem like the perennials.

"All collections should be arranged in some orderly manner, and each specimen named as far as possible. The common name will do at first, the proper scientific name to be attached later. Science means systematized knowledge, and its first law is order; so notes and specimens should be kept in some well-thought-out order and improvements made as knowledge of the subject is acquired."

In reply to the same question, Dr. A. C. Stokes writes a list of topics for study as follows:

"Hairs, glands, scales of plants—a field practically unlimited. Scales of insects: how many different forms, how many ways attached, what surface markings. Internal crystals of plants, (raphides, sphæraphides, long-crystal prisms, etc.): what plants contain each kind. The wonderful variety in the cell form in the epidermis of leaves, of petals, and especially of anthers of flowers. (This is good work, and easy with the method which I hit on of boiling in glycerin to make the whole thing transparent.) The different forms of insect antennæ—practically endless. The teeth of the different kind of flies—interesting and practically untouched in this country. The different forms of pollen. Stomata (breathing pores of plants); different forms and differing cell structure (use $\frac{1}{4}$-inch objective). Teeth of land and of water snails (almost endless variety for $\frac{1}{4}$-inch). Insect eggs: different forms and markings; for low powers; opaque; endless. The trouble with the Agassiz members is that they spread themselves over too much space, and so accomplish little or nothing. If each member or each chapter would select some subject and investigate that only, even for a limited time, the result would be better. There is no end to the subjects that the beginner could investigate. All he needs is to be started and to stick to some single subject till he becomes an amateur expert in it."

QUESTIONS.

NOTE—*These questions are addressed to all our readers, who are invited to send answers for publication in a subsequent number. In replying, say as much as possible in as few words as possible.*

The Lord's Prayer has been written on glass with a diamond and inside 1-28,000th of a square inch. What is the process?—L. M.

What known locality is richest in variety of fossil diatoms? What in fresh-water diatoms? What causes determined the quantity of diatoms in any given deposit?—H.

What is the best method of collecting corpuscles from blood stains and then of mounting them?—H. M. F.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

129. How are microtome knives to be kept in sharp condition?—R.

The knife must be carefully honed on a perfectly even and flat oil-stone. The process is similar to that of honing a razor. This sharpening should be done habitually after using the knife, and before it is laid away. The stone should be very fine, and one too hard for a barber's hone, "because it cuts too slowly," is just the sort of a stone to put a very fine, smooth edge on a microtome knife. If the knife has been nicked it should be sent to the cutler to be ground to a smooth, straight edge, and be honed as if it were a razor. A piece of good calfskin glued to a flat wooden back may be used as a strop to keep the edge keen, at intervals during the cutting of sections.

130. How are vegetable sections to be preserved while awaiting opportunity to mount them?—R.

They are best preserved in alcohol, especially if they are to be mounted in balsam. If intended for glycerin or glycerin jelly, preserve them in glycerin and water, equal parts, with a little camphor or carbolic acid added, to prevent mould. Sections preserved in this latter fluid may be mounted in balsam if the glycerin be carefully removed by soaking them in several waters.

131. Will vegetable stains fade out if exposed to sunlight?—R.

Sunlight is a very powerful bleacher, and unnecessary exposure in it should be avoided. Vegetable sections stained in carmine, picro-carmine, or logwood may be regarded as permanent. Sections stained in the aniline dyes are not permanent, as a rule, and will quickly fade in sunlight.

132. In double-staining a section should a light or dark stain be used first?—R.

That depends upon the chemical characteristics of the staining fluid, not upon the hue. Some aniline dyes may be used together, as safranine and methyl green. The following double stains should be used separately and in the order named: carmine and logwood, logwood and eosin, picro-carmine and aniline green or blue, carmine and indigo-carmine. Picro-carmine, rosein and indigo-green, used in this order, will produce a triple staining in suitable objects.

133. Is there any method for tempering the paraffin to the density of a section so that it will cut evenly? If so, what is it?—R.

Paraffin is not usually tempered for this purpose. It is graded to have a certain melting point or hardness, which will cut smoothly at a certain temperature of the surrounding air. If the paraffin proves to be too hard, by crumbling or otherwise, raise the temperature of the air in the room, or reimbed the specimen, using more of the soft wax. A hard paraffin will allow a very thin section to be cut, but it rolls tightly and is very troublesome to flatten. A very soft paraffin does not support the tissue well. It will crowd up or wrinkle or break. A paraffin melting at 125° F. will usually cut well at a temperature of 70° F.

134. What microscope can a beginner get for little money, that will be of some use to him?

For a beginner the Excelsior Microscope, listed at $2.75, can be recommended. This instrument consists of a small oblong box containing a mirror, and a rod which can be erected; also a pocket magnifier with three lenses, and an adjustable stage which will slide upon the rod. The whole forms an easily used, simple microscope. But one cannot do much real work without a compound microscope. The cheapest one that will be at all satisfactory will cost at least $28.00. The so-called "School" or "Household" microscopes, or other such cheap instruments, are worse than none, because their imperfect and misty definition will do much to discourage a student. A microscope, if good, will not only aid study but encourage it.

SCIENCE—GOSSIP.

To Preserve Impressions of Leaves.—Those who desire to preserve impressions of leaves of trees and plants can do so in the following simple manner: At any druggist's get a nickel-worth of bichromate of potash, and put it in a 2-oz. bottle of soft (rain) water. When the water has dissolved as much as it will of the potash, pour off the clear liquid into a shallow dish. On this float a piece of ordinary writing-paper till it is thoroughly saturated. Let the paper be hung on a piece of string in the dark until it gets nearly dry, when it should be in color a bright yellow. On this put the leaf, and under it a piece of black cloth and several sheets of newspaper. Put these between two pieces of clean window-glass of the same size, and hold them together with spring clothes-pins or with spring clips similar to those used for holding letters or bills. Expose to a bright sun, placing the leaf so that the sun's rays will fall upon it as nearly perpendicular as possible. In a few minutes it will begin to turn brown,

but it requires from half an hour to several hours to produce a perfect print. When it has become dark enough, immerse the paper in a dish of clean water, which must be changed every few minutes, until the yellow part becomes perfectly white. The print can then be mounted in a scrap-book.—*Adapted from "Work."*

The Doctor's Microscope.—The microscope has now become an indispensable instrument in medical practice, without which the physician must often work without the knowledge which his patients justly expect him to command.—*Boston Medical and Surgical Journal.*

Oil of Anise-seed as an Imbedding Medium for the Freezing Microtome.—Dr. H. Kühne has discovered that oil of anise-seed may very successfully be used as an imbedding medium for cutting sections with the freezing microtome. The procedure is as follows: Pieces about 2 mm. thick are placed on blotting-paper to remove the alcohol, and then immersed in a capsule containing the anise-seed oil for 12–24 hours. When thoroughly saturated with the oil—and this is easily recognized by the clearing up of the material—the pieces are placed on the microtome and sectioned. The sections are temporarily transferred to anise oil on a glass rod, and when all the piece is sectioned, are placed in alcohol (twice repeated) to remove the oil. When all the oil is removed, the sections are ready for staining.—*Jour. Royal Micr. Soc., Oct., 1892.*

Methylen-blue Staining of Nervous Systems of Invertebrata.—Herr O. Bürger, when investigating the nervous system of Nemertine worms, seems to have obtained very good results, judging at least from the colored illustrations said to be faithful representations, by injecting these animals with a fluid made by dissolving 0.5 grm. methylen-blue in 100 grm. of ½ per cent. cooking salt solution, or with a simple watery solution of the same strength. Sea-water, in which methylen-blue is perfectly soluble, is quite unsuitable for the purpose. The injections were made frequently, one injection imparting only a faint staining. The best period for injecting was in the half-dead condition, or in that state when the animal or parts thereof still show signs of life. The time required for bringing about good injection results was at least 6–8 hours, and sometimes much longer. After a time the author found that satisfactory results were more easily obtained by merely injecting a part or organ. The preparations were fixed with dilute picrate of ammonia and afterwards put up in glycerine to which a trace of ammonia had been added.

The staining does not last very long, and hence in examining a specimen it is advisable to begin at those parts from which the blue color first disappears, viz., at the periphery.—*Mittheil. Zo. Station zu Neapel—1891.*

RECENT PUBLICATIONS.

Le Micrographe Preparateur.—A monthly journal. Vol. 1. No. 1. January, 1893. J. Tempère: Paris.

Our friend Tempère, of Paris, has just commenced a microscopical magazine of the same size as *The Microscope.* As it is published in French, we are sorry to think that but few copies will be taken in the United States. Those microscopists, however, who read French are invited to send to us for a sample copy and to subscribe.

The contents for January are as follows:

1. Editorial announcement, 1 page—the editor.
2. Technique of Preparations, 3pp.—Tempère.
3. Cryptogamic maladies of cultivated plants (I. The grape vine), 5pp.—Dutertre.
4. The genus *Vaucherai*, 2pp.—M. L. Dupray.
5. Adulterations (I. Of pepper), 4pp.—A. Deros.
6. Correspondence, Exchange, etc., 1 page.

The second, third, and fourth articles are illustrated. In all, twelve figures are presented and grouped in one lithographed plate.

Mr. Tempère has granted us permission to translate articles for our Journal, which we shall occasionally do. He speaks and writes remarkably good English himself, and has been much amused by some American translations that have been made of his articles in *Le Diatomiste* during 1891 and 1892.

The price of *Le Micrographe Preparateur* is $3.00 per year. Subscriptions will be received by us at $2.75—club rate.

The Microscopical Examination of Potable Water.—By Geo. W. Rafter. D. Van Nostrand Company, N. Y.: 1892. Price, 50 cents. 16mo, 160pp.

This little hand-book belongs to the Van Nostrand Science Series (No. 103) and is based upon a paper published several months since in the *Microscopical Journal.* There have been added some valuable tables, a diagram, and a classified list of 150 books, journals, and micellaneous papers bearing upon the subject. The 19 classes are as follows: Water in its chemical, biological, and sanitary relations (51 titles); general botany (3); cryptogamic botany (2); fresh-water algæ (5); desmids (3); diatoms (5); fungi (6); general zoölogy (3); microscopical crustacea (3); rotifers (2); polyzoa (3); infusoria (3); rhizopods (1); sponges (4); general physics (3); light and its relations (3); optics (5); the microscope and microscopical technology (25); miscellaneous, biology, etc. (20).

THE MICROSCOPE.

MARCH,

1893.

NUMBER 3. (NEW SERIES.)

AMERICAN SOCIETIES INTERESTED IN MICROSCOPY.—II.

BY CHAS. W. SMILEY,

WASHINGTON, D. C.

(Continued from page 11.)

Since publishing the provisional list in January some very interesting facts have come to light, but from many societies nothing has been heard. Mr. Geo. Otis Mitchell, of San Francisco, has placed at our disposal all the information that has been collected by the San Francisco Microscopical Society. Much of it is incorporated in this article.

The inquiry has revealed the fact that 15 societies have ceased to exist, or at least suspended action indefinitely. The list is as follows, and we desire that those who know the facts will inform us when these societies discontinued holding meetings, and for what reasons.

LIST OF FIFTEEN SOCIETIES REPORTED DEAD.

California.—California Microscopical Society, Girls' High School, San Francisco, Cal.

Indiana.—Indianapolis Microscopical Society, Indianapolis, Ind.

Maine.—Portland Microscopical Society, Portland, Me.

Maryland.—Baltimore Microscopical Association, Baltimore, Md.

Massachusetts.—Boston Microscopical Society, Boston, Mass. (Became a section of the Boston Society of Natural History.)

Wellesley Microscopical Society, Wellesley, Mass.

Michigan.—Griffith Microscopical Society, Detroit, Mich.

Minnesota.—Minneapolis Microscopical Society, Minneapolis, Minn.

New Jersey.—Camden Microscopical Society, Camden, N. J.

New York.—Dunkirk Microscopical Society, Dunkirk, N. Y.

Jamestown Microscopical Society, Jamestown, N. Y. Amer-

ican Microscopical Society. New York city. Rochester Microscopical Society. Rochester. N. Y. (Absorbed by the Rochester Academy of Sciences.)

Pennsylvania.—Bethlehem Microscopical Society. Bethlehem. Pa.

Rhode Island.—Providence Franklin Society. Providence, R. I.

Of these 15 societies, 4 were reported in our list on page 10. The others have been added to show the remarkable decrease in societies during the past few years. Out of a total of 70 societies thus far discovered, 15 have died within 3 or 4 years.

List of Eight Societies Reported Additionally to the List of Fifty on pp. 10–11.

Illinois.—Microscopical Section. Chicago Academy of Science. Chicago. Ill. (Same as the Illinois State Microscopical Society.)

Iowa.—Council Bluffs Microscopical Society. Council Bluffs, Iowa.

Michigan.—Michigan Teachers' Society of Microscopists, Ypsilanti, Mich.

New York.—Canandaigua Microscopical Society, Canandaigua, N. Y.

Ohio.—Tyndall Association. Columbus, Ohio. C. C. Howard, M. D., Secretary. Ohio State Microscopical Society. Columbus. Ohio.

Pennsylvania.—Erie Microscopical Society, Erie, Pa.. Rev. Geo. Goetz, Sec'y.

Tennessee.—Memphis Microscopical Society. Memphis, Tenn.

Texas.—Austin Microscopical Society. Austin, Texas. Dr. T. J. Bennett, Sec'y.

The following information has been furnished by the secretaries of the different societies, and a considerable part of it had been collected by Mr. Mitchell before the publication of our provisional list of societies.

Many other societies, yet to be heard from, are earnestly invited to reply to the following questions:

1. In what year was the society organized?
2. In what year incorporated (if at all)?
3. Has it printed copies of its constitution for distribution?
4. What is the regular time for meetings?
5. How many members (specify active, honorary, etc.) has it?
6. What are the membership fees?
7. What microscopes and accessories does it own?
8. About how many mounts has it?

9. How many books, pamphlets, etc.? (Specify the most important.)

10. What is the average attendance at meetings?

11. How is an account of the meetings published?

12. Who are the president, secretary, and treasurer for 1893?

13. Add any other items of general interest.

United States.—American Microscopical Society. (National.)

Organized at Indianapolis, 1879. Incorporated, Washington, D. C., 1891. Constitution printed in proceedings. Meets annually in August. Average attendance, 30. Number of members, 381 in 1891. Annual dues, $2.00. Has published 13 annual reports. Owns no books nor instruments.

President, Prof. J. D. Cox, Cincinnati, Ohio; Vice-President, Dr. Geo. M. Sternberg, U. S. A.; Vice-President, Dr. A. Clifford Mercer, Syracuse, N. Y.; Secretary, Dr. Wm. H. Seaman, 1423 11th street, Washington; Treasurer, C. C. Meller, Pittsburg, Pa.

United States.—American Postal Microscopical Club. (National.)

Organized 1875. Not incorporated. Constitution not in print. No meetings are held. Membership, about 140 (list published). Publishes a report annually. Dues, $1 per year. No property, books, microscopes, etc.

President, Prof. Samuel Lockwood, Freehold, N. J.; Secretary, S. G. Shanks, M. D., 547 Clifton ave., Albany; Manager, R. H. Ward, M. D., Troy, N. Y.

California.—San Francisco Microscopical Society.

Organized June 4, 1870. Incorporated Aug. 30, 1872. Annual meeting, 1st Wednesday in February. Meetings, 1st and 3d Wednesdays at 432 Montgomery st., 8 P. M. Initiation, $20. Monthly dues, $1. Regular members, 60; life, 8; honorary, 8; corresponding, 27.

Library of about 1,000 bound volumes, and 100 pamphlets. Cabinet of nearly 5,000 slides. Reports of meetings have been published in local papers and in *Microscopical Journal*. Is commencing to publish Journal of the S. F. M. S. Owns large Beck stand, large Zeiss stand, large Nachet stand, several mounting and dissecting stands, Zeiss photomicrographic apparatus, Yung's large microtome, bacteriological apparatus, etc., etc.

A very extensive collection of diatomaceous earths from all over the world.

President, A. H. Breckenfeld, 1 and 3 Samson St.; Vice-President, Dr. Douglass W. Montgomery, 1124 Sutter street; Recording Secretary, Wm. H. Loy, 423 Clay St.; Corresponding Secretary, George Otis Mitchell, 1034 Pine St.; Treasurer, C. C. Reidy, 432 Montgomery St.

Colorado.—Denver Microscopical Society.

Organized 1883. Incorporated 1888. Membership, 18. Meetings, 2d and 4th Mondays. Library of 500 vols.

President, Prof. H. F. Wegener; Vice-President, W. Edmundson, M. D.; Secretary and Treasurer, J. B. Kinley, M. D.

Illinois.—State Microscopical Society of Illinois, Chicago.

Has become a section of the Chicago Academy of Sciences, retaining its own name and charter and articles of incorporation. Organized April 23, 1868. Incorporated March 31, 1869. Has printed constitution. Meets the 2d Friday of each month, from October to May. Has 120 active members. The section has no dues and no expenses. Each member, however, pays $5 per annum for membership in the Academy. The section owns considerable apparatus. The average attendance is from 30 to 40 The proceedings are published in the records of the Academy of Sciences. The section has been assigned 360 feet of space at the World's Fair for the purpose of making an exhibit. Activepreparations are going on. Chairman of section, H. L. Tolman; Recording Secretary, Prof. F. L. Morse; Treasurer, Wm. H. Summers, 3450 Cottage Grove avenue; Corresponding Secretary, C. O. Bering; Vice-Presidents, B. F. Quimby, D. W. Chapman.

Kansas.—Sphinx Society, Atchison.

There is some question regarding the propriety of classifying this society as microscopical, although a large number of its members are interested in microscopy and frequently read papers bearing on the subject. From 1889 to 1891 there existed at Atchison a purely microscopical society, that gradually merged into the Sphinx. The latter was organized in November, 1890, and is not incorporated. It has no printed constitution. It meets fortnightly, on Thursday evenings, from October to June. Average attendance, 10; number of members, 22 active, 3 honorary. Dues 50 cents on entrance, and assessments as required. No apparatus, mounts, nor books. No account of meetings published. President, A. H. Lanphear, M. D.; Secretary and Treasurer, E. B. Knerr, Sc. D.

Kansas.—The Kansas Pharmaceutical Society contemplates organizing a microscopical section with the view to maintaining a State organization for microscopy. L. Ardery, Hutchinson, Kansas, is said to be Secretary.

Michigan.—Michigan Teachers' Society of Microscopists, Ypsilanti.

Organized June 22, 1891. Not incorporated. Constitution hectographed. Meetings held annually during commencement week of Michigan State Normal School; average attendance, 12. Meetings reported in the *Naturalist Teacher*. Membership, about 15; annual dues, 25 cents. No apparatus, mounts, nor books.

President, C. D. McLouth, Muskegon; 1st Vice-President, W. F. Lewis, Ypsilanti; 2d Vice-President, J. Q. Roode, Hanover; Secretary, F. E. Andrews, Ypsilanti; Treasurer, M. W. Wimer, Mt. Pleasant.

"The object of this society is to encourage the use of the microscope in the public schools."

The society exists mostly on paper. A great obstacle to progress is the fact that members do not own microscopes. Being teachers, their microscopes are things of the future, which will probably never come to most of them. Society was originally organized from a class (the first taking that work) in "biological training," Michigan State Normal School.

Missouri.—St. Louis Club of Microscopists.

Organized May 7, 1887. Not incorporated; 21 members; meetings, 2d Monday, at College of Pharmacy, 2108 Lucas Place. Library, 25 bound volumes of journals. Cabinet, 200 slides, principally drugs. Chief aim is the advancement of microscopy as applied to pharmacy and the allied sciences among pharmacists.

President, J. C. Falk, M. D.; Vice-President, Thos. A. Buckland; Secretary, S. E. Barber; Treasurer, H. M. Whelpley, M. D.

Nebraska.—Lincoln Microscopical Club.

Organized January 25, 1872. Not incorporated. No printed constitution. Meetings, last Tuesday of each month. Average attendance, 15; 26 active, 1 honorary, 2 non-resident members. Dues, $1 per annum. Meetings reported in *American Microscopical Journal.* No apparatus, mounts, nor books. Those belonging to the University of Nebraska are available to the members. President, A. F. Woods, Botanical Laboratory, University of Nebraska; Secretary, Roscoe Pound, Burr Block; Treasurer, J. S. Dales.

Nebraska.—Omaha Microscopical Society.

Organized March 17, 1892. Not incorporated. Members, 20. Formerly met weekly, now rarely. Meetings reported in Omaha *Clinic.* No apparatus, mounts, nor books.

President, Irvin Leviston; Secretary, Geo. Wilkinson, M. D.

New York.—Brooklyn Microscopical Society.

A department of the Brooklyn Institute of Arts and Sciences; made a department in 1888. Meetings, 1st Monday of each month; membership, 133. Institute publishes Year Book.

President, S. E. Stiles, M. D.; Vice-President, J. W. Freckelton; Secretary, Geo. E. Ashby; Treasurer, Edward C. Chapman.

New York.—Nyack Society of Microscopists, Nyack-on-Hudson.

Organized, May, 1891, with 7 members. Membership, 14. Meetings, 1st Wednesday. Cabinet, 170 slides. Library started.

Officers: President, Dr. G. F. Blauvelt; Vice-President, Frank Prevost, Esq.; Recording Secretary, Miss C. M. Whitaker; Corresponding Secretary, J. C. Gregory; Curator, Prof. Ira Lawton.

New York.—Canandaigua Microscopical Society.

Organized and incorporated June 8, 1880, with 11 charter members, 25 active and 7 honorary members (8 ladies). Meetings, 2d Tuesday in each month except July and August.

President, Rev. N. M. Calhoun; Vice-President, Prof. E. H. Eaton; Secretary and Treasurer, Dr. Charles T. Mitchell.

New York.—Microscopical Section of Troy Scientific Association, Troy, N. Y.

Organized 1870. Incorporated 1874. No printed constitution. Meets 1st Monday of each month. About 70 active members of the association. Dues $2 per year. No instruments, mounts, nor books to mention. No reports published.

President, R. H. Ward, M. D.; Corresponding Secretary, Geo. H. Ennis; Treasurer, Joseph McKay.

Ohio.—Ohio State Microscopical Society, Columbus, O.

Organized Oct. 11, 1887. Not incorporated. No printed constitution. Meetings, the last Friday of each month, except July and August. Average attendance, 12. Active members, 25. Dues, $1 per annum. No instruments, mounts, nor books. Reports published in local papers.

President, O. Frankenberg; Secretary and Treasurer, A. Feiel; Trustees, H. A. Weber, H. J. Detmers, Dr. C. R. Vanderburg.

Pennsylvania.—Iron City Microscopical Society, Pittsburg.

Membership, 91. Initiation, $2. Dues per year, $3. Library, about 400 vols.

President, Dr. T. L. Hazzard, Alleghany; Vice-Presidents, Prof. J. Tingley, Alleghany; Dr. C. Q. Jackson; Recording Secretary, Dr. Hiram Depuy; Corresponding Secretary, J. F. Henrici; Treasurer, Jas. A. Moore.

Pennsylvania.—Philadelphia Academy of Sciences.

Biological and Microscopical Section organized March 30, 1858.

Texas.—Austin Microscopical Society, Austin.

President, Dr. J. W. McLaughlin; Secretary, Dr. T. J. Bennett.

Canada.—Microscopial Section of the Entomological Society of Ontario.

Section organized November 15, 1890. Not incorporated, but the society was incorporated in 1870. Constitution not printed. Section meetings, 1st and 3d Fridays of each month. Active members, 13. Dues, $1 for membership in the Entomological Society.

The society owns 2 microscopes: (1) a Carpenter & Westley monocular, with polariscope, 4 objectives, 1 eyepiece: (2) a Zentmayer binocular, with 6 objectives, 5 eyepieces, a double nose-piece, parabolic reflector, polariscope, camera lucida, turn-table, frog-plate, live-boxes, condensing lenses, etc. The society owns 171 mounts and 23 microscopical books, including Beale, Carpenter and Micrographic Dictionary.

The proceedings of the society are published in an annual report at the government's expense.

Leader of section, John Bearness, professor of zoölogy in Western University; Secretary, H. A. Stevenson; Treasurer (of the society), J. Blackwell. Each section presents a report to the society at its annual meeting. The sections use the library rooms, etc., of the society, and the members have all the privileges of the society on payment of the fee. The rooms are always open. The society has fine collections of insects and publishes the *Canadain Entomologist*. The library contains 1,214 volumes and many pamphlets. Besides the Microscopical Section, there are sections in Ornithology, Botany and Geology.

THE MICROSCOPE IN PUBLIC SCHOOLS.

By Wm. W. WEIR,

SOUTH FRANKFORT, MICH.

[From The Naturalist Teacher.]

I am using a microscope in my school. I have a regular hour set apart when each pupil comes to the glass and makes his observation, passes quietly to his seat, and the next comes, and so on till all have made an observation. From the outset great interest has been manifest. A great majority are enthusiastic. During the noon and recess hour there is a throng at my desk seeking admission to the glass.

In the higher grades, I use the glass mostly for technical purposes. In the lower grades, the main purpose is to please—but even here I find appreciation. It is amusing to see the primary children crowd around the table exultant with joy, when the glass goes to their room. I believe that there is more disciplining power in the microscope than in iron-clad rules or rods. Bring the microscope into a room where all is confusion, and instantly the scene is changed.

I have not met with any opposition from patrons. Should such a thing come in the way of the free use of the microscope, I would hold a public microscopical entertainment, inviting the general public, giving them a genuine demonstrationiof the use and utility of microscopical work.

Before using the microscope, I used a strong Coddington lens with good success. Plant tissue can be very well appreciated with a good lens, also the various parts of insects; and it leads up to the demand for a better glass. Long before I began using the microscope, my pupils proposed getting up socials and entertainments for the purpose of purchasing a glass for the school. The time is not distant when every graded school in the State will have the microscope as a part of its needed apparatus.

BACTERIA IN ICE.

By M. Noll.

ATCHISON, KANS.

[Abstract of a paper read before the Sphinx Society, and reported by E. B. Knerr, Secretary.]

Impurities may occur in even the best of ice. Samples obtained from the Missouri river, the lakes and creeks in the neighborhood of Atchison, and from the Atchison city reservoir were subjected to chemical and biological analysis. In all, more or less organic substance was found, especially in that from the creeks. But the biological examination is of especial interest to those interested in microscopy. It is commonly supposed that life in ice is impossible, but in all specimens examined life was found at least in the dormant or spore condition. Fragments taken from the centres of large blocks of ice were carefully washed with sterilized and distilled water and quickly placed into sterilized tubes containing nutrient gelatin. So rapidly did the bacteria multiply that in three days they became visible as a hazy cloud near the surface. In a few more days the gelatin was liquefied and full of them. Check tubes of the same solutions, prepared at the same time and under the same conditions, but without the addition of ice, presented no bacterial growth whatever, even after the lapse of a month. Plate cultures were also made, and from the colonies thus developed several different species of bacteria were isolated. It was thought, however, that none were of a harmful nature. Ice from the creeks gave the greatest variety of growth, while that from the Missouri river showed the least variety.

Poisons.—Have a special closet for all poisons and do not let people have access thereto indiscriminately. Have all the packages properly labelled, but, to prevent involuntary accidents, keep them in no particular order and never put the same package twice in the same place.

A PNEUMATIC BUBBLE REMOVER.

By A. P. Weaver,

JACKSON, MISS.

Being annoyed with air bubbles in my mounts, I have made a simple air-pump for removing them, as follows: Take a small rubber syringe, the packing on the cylinder of which ought to be adjustable so as to fit the body of the syringe rather tightly; cut off the nozzle rather close to the body, and bore a hole 3 *mm.* in diameter near the top of the latter, so that the packing will always be below the hole. Cut from an old rubber boot two washers 2.5 *c.m.* in diameter and with a central aperture of 2 *c.m.*: cement these washers together with Red Cross cement (such as is used for mending punctures in pneumatic bicycle tires); cut from the boot two more washers of the same outside diameter and with a central hole a little smaller than the nozzle of the syringe; cement these last two washers together also, and cement them to the first two prepared; you will now have a shallow chamber a little larger than the cover-glass. Force the nozzle of the syringe through the opening in the two top plates and firmly cement it there. All these joints must be air-tight.

To use the instrument, place the slide on a smooth surface, wet the under surface of the rubber washers and apply the same to the slide with the cover-glass in the shallow chamber. To make a good air-tight contact with the slide, grasp the syringe with the left hand and allow the lower side of the latter to hold the washers firmly to the slide. The hole drilled in the syringe is to act as a trap or valve and is to be tightly covered with the first finger of the left hand (keeping the latter in position, grasping the syringe and holding the washers to the slide) at each downward stroke of the piston and uncovered at each upward stroke. This is, of course, done to prevent the entrance of air to the vacuum chamber beneath, after it has once been exhausted. I have found that three or four strokes are sufficient to bring all bubbles to the surface of the mounting fluid and cause them to burst.

MICROSCOPE EYEPIECES.

By O. Beckerlegge.

There is this difference between the eyepiece of a telescope and microscope: on a telescope a much higher power can be used than on a microscope. In the former a long focus object-glass is used: consequently the image is not magnified to any great extent: the main magnification is made by the eyepiece. In the microscope the object-glass is of short focus, and consequently magni-

fies the object in proportion. For example, suppose normal sight is 10 in.; then, if we use a lens which has a focal length of 5 in., the eye is brought twice as near to the object, and consequently the object will appear twice as large; or if we use a lens $2\frac{1}{2}$ in., then the diameter will be magnified four times, and so on, up to $\frac{1}{2}$ an inch or other higher power. Of course a high-power eyepiece could be used on any object-glass. But there is this drawback: in all object-glasses of high power, except those of the highest possible quality, there will be some little defect, and to use a high-power eyepiece would be to magnify the image of the object, defects and all. Thus, from the construction of the instruments, a much higher power eyepiece can be used on the one than on the other.

Eyepieces for the microscope are sometimes designated A, B, C, D, etc. They consist of two lenses: a large one nearest the object-glass, called the field lens, and a small one nearest the eye, called the eye lens.

A general rule for diameters is that the field lens should be twice that of the eye lens; thus, if the field lens is 1 in. in diameter, the eye lens should be about $\frac{1}{2}$ in. in diameter. The rule for local length is that they should be as 2 to 1; thus, if the field lens is $1\frac{1}{2}$ in., then the eye lens must be $\frac{3}{4}$ in. These are placed with their plane side towards the eye, and one-half of their combined focal length apart; thus $1\frac{1}{2} + \frac{3}{4} = 2\frac{1}{4} \div 2 = 1\frac{1}{8}$, so that they would be $1\frac{1}{8}$ in. apart. A stop must be placed between these at the focus of the eye lens, the opening the same as its diameter.

To determine the focal length of the eyepiece, proceed as follows: Multiply the focal length of the lenses into each other and then by 2, and divide the product by the focal lengths when added together; thus $1\frac{1}{2} \times \frac{1}{2} \times 2 = 1\frac{1}{2} : 1\frac{1}{2} + \frac{1}{2} = 2 : 1\frac{1}{2} \div 2 = \frac{3}{4}$, so that the eyepiece constructed by these lenses would be $\frac{3}{4}$-in. focal length.

The following are given by a manufacturing optician:

1. Eye lens, $1\frac{1}{2}$; field lens, 3; distance apart, $2\frac{1}{4}$.
2. Eye lens, 1; field lens, 2; distance apart, $1\frac{1}{2}$.
3. Eye lens, $\frac{3}{4}$; field lens, $1\frac{1}{2}$; distance apart, $1\frac{1}{8}$.
4. Eye lens, $\frac{1}{2}$; field lens, 1; distance apart, $\frac{3}{4}$.

In making eyepieces for the telescope, the relative focal length of field lens to eye lens is 3 to 1. In mounting the lenses in their cells, the plan already given should be followed. With these principles, any clever worker in brass should find no difficulty in making any required eyepiece.— *Work*, *April*, *1892*.

To Fix Paper on Glass or Metals.—The *Revue Photographique* gives the following, which is said to be excellent: Mix 30 gm. tragacanth and 120 gm. gum arabic, and dissolve in 500 gm. distilled water. Filter and add 2.5 thymol dissolved in 120 cem. glycerin.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Public Office.—On the day of Grover Cleveland's inauguration we received the following request from a subscriber:

"It is my intention to make application for appointment to the office of microscopist in the service of the bureau of Animal Industry. May I call for the assistance which you can render me in the way of a letter of opinion as to my qualifications?"

The reply made may be of interest to others similarly minded:

"Before taking any step of the sort desired, I should like to know by whom the place is already occupied. Is the occupant capable or incapable? Is he a man thoroughly devoted to his work, or did he neglect his work in the late campaign to talk politics? Is he one of the Harrison victors to whom belonged the spoils four years ago? If so, we ought, as good Cleveland men, to see to it that the rascal is turned out; but what is to be gained if we turn out one rascal to make place for another? It is our recollection that the fellow wanting the place never considers himself the rascal; it is always the incumbent who is the rascal. Being disciples of Grover Cleveland, we think the rascals should be kept out so as to save a President the trouble four years hence of "turning the rascal out." In short, if the present incumbent is holding his place by hard work, and remembering in a practical manner that public office is a public trust, we shall not help to put him out. If he is a spoilsman, we want to see him replaced, not by another spoils hunter, but by a man who will show by his conduct that he holds public office to be a public trust, and incidentally we hope he will be an advocate of tariff reform and of one-hundred-cent dollars."

QUESTIONS ANSWERED.

Note.—Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.

135.—Are the beautiful eggs of insects marked as we see them, when laid? How are they prepared?—Insecta.

Insect eggs are naturally marked as we see them. The writer has stripped a female Ephemera Vulg. and received the eggs in a microscopical tank of water. The eggs were beautifully marked from the beginning, and remained so until hatched, 26 to 30 days later. Insect eggs may be mounted dry or in balsam in a cell.

136.—If a bud taken from a fruit-tree in midwinter be sectioned, how much of the future fruit or embryo may be seen? —E. C. H.

In the case of trees that produce blossoms before the leaves are fully developed, the flower-buds would show the rudimentary ovaries. The leaf-buds and flower-buds of some fruit-trees, as the peach, are on different parts of the stemlets, and the flowers develop before the leaves.

137.—How may I imbed small insects and make sections of material containing chitine?— W. W. N.

Insects may be imbedded in celloidin. Openings should be made in the side of small insects, and the large ones divided into lengths so as to open the body cavity and allow the celloidin to penetrate and support the internal structures. A strong chisel-like knife should be used, and rather thick sections expected. Chitine cannot be softened except in strong acids, which would destroy the softer parts of the insect.

138.—The Washington Micro. Society has a slide containing the Lord's Prayer, written with a diamond, in a space of the one twenty-eight-thousandth part of a square inch. How was it done?—L. M.

The instrument used by Mr. Webb for producing these objects was practically a small pantagraph. A stylus, attached to an arm, was traced over a "copy," and this motion, reduced by levers, was followed exactly by the diamond splinter and thus traced on the glass. It is said that Mr. Webb was accustomed to write the Lord's Prayer in spaces of the 1-500th to the 1-1,000th part of a square inch, and occasionally to the 1-405,000th part of a square inch. These numbers mean surfaces. The Washington object is written in a space of about 1-167 inch square. The finer writing occupies a space of about 1-636 inch square.

The *Am. Mo. Mic. Journal*, vol. vii. page 115, contains some information regarding minute writing by Mr. Webb.

139.—What is the best method for resurrecting blood corpuscles from blood stains and clots, and how best mounted?—H. M. F.

No method has yet been devised which will satisfactorily restore dried blood. A prolonged soaking in a fluid of the same specific gravity as blood serum, say a $\frac{3}{4}\%$ solution of salt, or a glycerin solution, or some such fluid, will soften the clot, but the corpuscles will never regain their normal form and size; they will be distorted, wrinkled, and shrunken. If one will consider the extremely delicate and peculiar character of blood corpuscles, it will be evident that changed blood cannot be completely restored. If corpuscles be removed from the flowing blood current by escaping into the tissues, or even when stagnated in the end of a tied artery, a clot is formed and the corpuscles adhere to each other. This is a physiological condition, the first stage of a disorganization and reorganization into a proper tissue, or at least into a harmless tissue in the case of the tied vessel, when the blood forms a fibrous plug, and later a harmless, shrunken cord. If blood is designed to change rapidly for the purposes of nutrition or repair, the restoration of a dried clot seems hopeless, but the field is open for original work in this line.

140.—How may sections of vegetable tissues imbedded in celloidin, be stained and cleared so the celloidin will become transparent?—B.

Tissues should be stained in bulk before being imbedded in celloidin. This substance, being practically cellulose, will be stained or discolored by nearly all the ordinary staining fluids, and the color cannot be discharged except by a chemical, which would also bleach the section.

141.—What is the duty on English microscopes imported into the United States?—Dr. Evans.

If for private use, 40 per cent. ad valorem. If for colleges or schools, and so proven, free of duty. See article on this subject in the *Microscopical Journal* for January, 1893.

142.—I am troubled by the slow hardening of my balsam mounts. Can I use mild heat, or can you suggest some other medium for quick work?—Amateur.

All balsam solutions harden slowly after the exposed surface has solidified. Mild heat is often used to hasten the hardening of balsam mounts. If the object will bear it the excess of solvent may be boiled away, or evaporated more gently over a lamp before covering, and the cover applied while the balsam is hot. When cold such mounts may be cleaned and finished immediately.

PRACTICAL SUGGESTIONS.

To Prevent the Reddening of Canada Balsam.—The tendency of Canada balsam to become red may be checked, and the balsam bleached, by the addition to the solution of a few crystals of pure metallic copper, precipitated from a copper sulphate solution by any of the ordinary methods. This process originated with the late Allen Y. Moore, of Cleveland, Ohio, and was the result of accident. What the philosophy of it is we do not know, as the copper crystals do not seem to be changed in any manner, even after long immersion in the solution of balsam.—*National Druggist, Dec. 1, '92.*

Bleaching.—Many drug sections require to be bleached before staining, but all traces of the bleaching material must be removed also. This, however, destroys and removes all the cell-contents.

Silk, wool, and similar fibres may be bleached by sodium superoxide (Na_2O_2), which is soluble in water. The liquid is neutral. The bleaching requires from 2 to 3 hours.

SCIENCE-GOSSIP.

To Measure the Magnifying power of a Microscope.—A camera lucida of some sort should be placed over the eyepiece to obtain the best result. A very simple one, indeed, may be made of a square of thin covering-glass tilted at an angle of 45° to the optic axis of the instrument. If with this arrangement the microscope tube be placed in a horizontal position, and we look down onto our piece of thin glass, the field will apparently be projected onto the table. Under these circumstances, the eye-end should be exactly 10 inches above its surface, and the whole instrument must be propped up until it is at this distance. We now require a stage-micrometer and a rule accurately divided to tenths of an inch. This latter we lay upon the table, 10 inches from the eyepiece, so that the magnified image of the divisions of the stage-micrometer shall be superposed on those of the rule. We then note how many divisions of the stage-micrometer correspond with any given number on our rule, and, dividing the latter by the former, obtain the magnifying power. For example, suppose that our stage-micrometer is divided to .001 inch, and suppose that 3 of its divisions = .003 inch exactly correspond to 0.6 inch on the rule. Then, dividing 0.6 by 0.003, we get 200 as the magnifying power with that object-glass, eyepiece, and length of tube. Had four divisions coincided with $\frac{1}{2}$ inch on our rule, the microscope would have magnified 125

times, and so on. The camera lucida is not absolutely essential, as the observer may view the stage-micrometer in the microscope with, say, his right eye, and holding the rule 10 inches from his left, shift it about until the image of the stage-micrometer is superposed on it as before; but this method is inferior both in comfort and accuracy to that described.—*English Mechanic.*

Objectives with Correction Collars.—In 1829 Amici first noticed that high-power objectives, which gave a perfectly clean image when objects, not covered with a glass, were examined, did not give so good a one when the object was covered, and that the clearness of the image increased and diminished according to the thickness of the cover-glass. To remedy this defect, which resulted from spherical aberration, Amici constructed his objectives in such a manner that they could all be used with cover-glasses of a definite thickness.

In 1837 the celebrated English optician, Ross, though ignorant of the discovery of Amici, made the same observation, and, to remedy the defect, he invented correction objectives.

In this kind of objective the two upper lenses occupy an invariable position with regard to one another. They are fixed in a movable tube, and can be made to recede from or approach the lower part, which is fixed, and carries the single or double frontal. By turning a ring the upper lenses rise or fall, and a coiled spiral spring regulates the small inequalities of the screw, and above all prevents the "back lash," which is always produced when the sense of motion is changed. The firm of Carl Zeiss engrave on their correction objectives a very practical series of figures. This series of figures, which extends from ten to twenty-five (or less), indicates at once the position to be taken for any given thickness of cover-glass. If we have, for example, to study a preparation covered with a cover-glass $1\frac{1}{2}$ tenths of a millimetre thick, the division 15 is placed against the index, and we shall have the best position of the lenses in which to study the preparation in question with axial light.—*From The Microscope by Van Heurck.*

Mounting Medium.—One of the best preparers of diatoms uses for a medium a mixture of Canada balsam and monobromide of naphthaline The refractive index of this mixture is much higher than that of balsam alone, while the image is clear and brilliant.

CORRESPONDENCE.

Replies to Questions.—The following questions, which were printed on page 32, have been answered by Arthur M. Edwards, M. D., Newark, N. J.

What known locality is richest in variety of fossil Diatoms?

The California deposit that includes Monterey, Santa Monica, and Los Angeles. This is marine.

What in fresh-water diatoms?

The fresh-water diatoms are fossil and recent. Any of those in the East of the United States—fossil—as at Bowkerville, N. H., called "Keene" and "Troy" deposits. The brackish diatoms, fossil, are found at Newark, N. J., and the fresh-water at Hatfield Swamp, N. J.

What causes determined the quantity of diatoms in any given deposit?

I cannot answer this unless it is more definite.

Divini's Microscope.—We are indebted to Mr. E. G. Love, of New York city, for the following:

I notice on the cover of *The Microscope* illustrations of three old instruments, the first being Divini's, dated 1657. This evidently is from Schott's *Magia Universalis*, and is one of several forms which are represented as of enormous size. The one in question, for instance, must have been from 6 to 8 feet long. It has always seemed to the writer that this cut gives a wrong impression regarding the size of this old microscope; and I think we must agree with the opinion expressed by the late Mr. Mayall, that the illustration does not represent the instrument as constructed. Mr. Crisp has suggested that the draughtsman who prepared the cuts for Schott's work probably knew nothing about microscopes, and instead of representing an eye looking into the tube, he drew the full-length figure, which gives such a ludicrous effect.

This explanation seems the more probable inasmuch as in Traber's *Nervus Opticus*, also refered to by Mr. Mayall, what is evidently the same instrument is figured with the eye only.

RECENT PUBLICATIONS.

Proceedings of the American Microscopical Society. Edited by the Secretary. Part I, October; Part II, January, pp. 1–132.

On the 8th of March, 1893, we were very much pleased to receive these two parts of the report for 1892. Part I contains the minutes, the constitution, presidential address, and papers by Ewell, Biscoe, Claypole, Griffith, Holbrook, Kraüss, Kellicott, and Rowles. Part II contains papers by Sternberg, Bell, Gage, and Rogers. The place for the next meeting will be either Madison or Chicago.

THE MICROSCOPE.

APRIL,

1893.

NUMBER 4. (NEW SERIES.)

OUTFIT RECOMMENDED FOR A BEGINNER.

BY DR. W. H. SYLVESTER,

NATICK, MASS.

In regard to a microscopical outfit for beginners, I would recommend the purchase of a low-priced but substantial stand, which should be capable of having accessories added to it as the owner's needs multiply. I am in favor of American stands, as I find them to excel the European in beauty and convenience, and to be equally good in point of workmanship. Of all the American makers, I am best able to speak of Bausch & Lomb, as I have had enough experience with their stands to recommend them as the equal of any in the world. While other American makers may be doing good work, my experience with their stands is not sufficient to judge fairly. Concerning Bausch & Lomb, I can speak from knowledge, as I have owned or used the most of their stands, and know them to be convenient and unsurpassed in durability. I prefer the American pattern, but this is largely a matter of education, as a stand of the Continental pattern is capable of good work, and for an everyday working stand has some points of advantage. If the Continental pattern be decided on I would recommend Bausch & Lomb's Medium Continental Style B B, as this has rack and pinion as well as fine adjustment. The price of this is $35.00 with one eyepiece. If one desire to economize, the rack and pinion can be dispensed with and a saving of ten dollars made. The sliding tube is really very convenient and effective after a little practice. In the American style, no stand is made for the money that at all approaches in durability and utility Bausch & Lomb's Model at $25.00. To this, almost any appliance can be added. It is thoroughly made, and adapted for any class of work, although

not so handsome as some of the other styles. It has a strong thin circular stage, to which can be added, when desired, the glass stage: a large double mirror capable of swinging above the stage, saving the expense of a bull's-eye for opaque objects: the new dome diaphragm, better in some respects than the iris; and the tube can be contracted to the short standard, allowing the use of objectives corrected to that standard if desired.

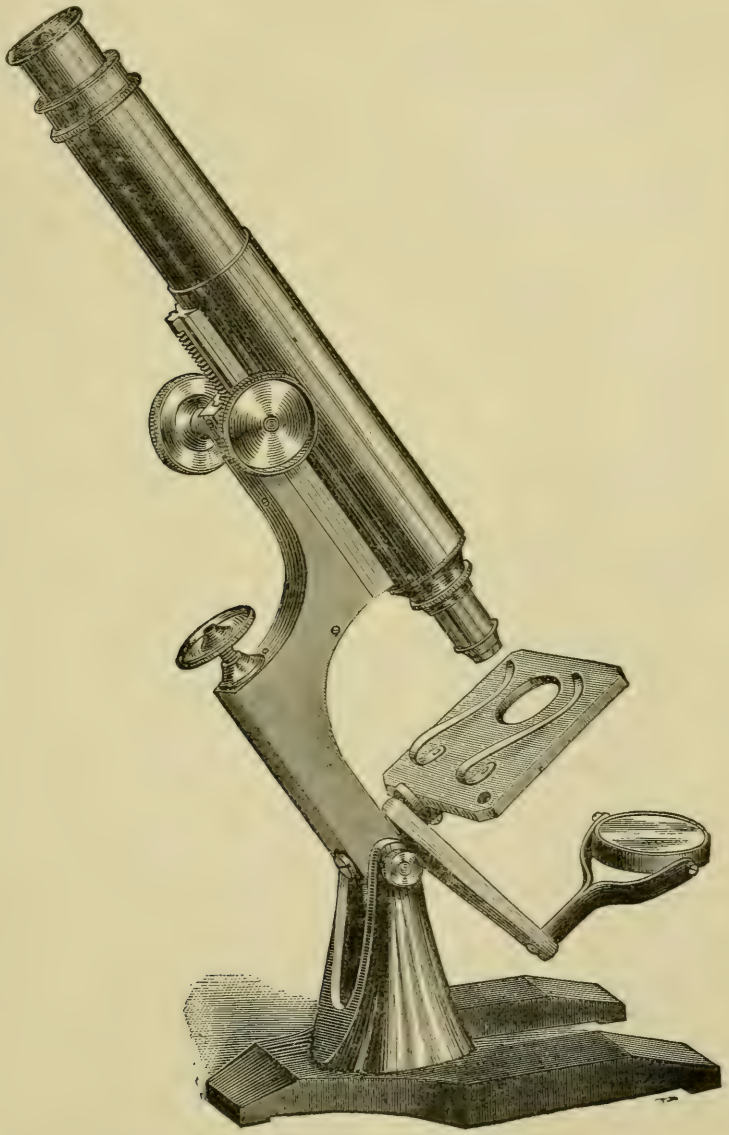
As to objectives, if the idea be still to get the best possible for the least money, I would recommend those of Leitz, as they are low in price and most excellent in quality and excel in those qualities that beginners need—long working distance and remarkably clear definition. While not of extreme angular aperture, the resolving power is good. I would advise the purchase of No. 3, about 7-10 in., and No. 7, about $\frac{1}{8}$ in. I should also suggest a double nose-piece so that both objectives may be kept on all the time while at work, as one will often neglect to use the proper power if it must be screwed off and on each time. No one accessory is of so much use as the double nose-piece. A camera lucida will be needed, and as good a one as can be afforded, though the common one at $1.50 will do good service. An eyepiece micrometer will also be needed, and one can be fitted to the eyepiece at a cost of $1.50. I would advise the selection of a B eyepiece and disc micrometer, if only one is to be purchased. Of course A and C would be better, but it is surprising how little use in real work there is for more than one eyepiece. If one can possibly spare $5.00 more, I would advise that this stand be fitted with the adjustable mirror bar, as it will be needed when a condenser is purchased and is far more convenient for everyday work. Of course I could name many more useful accessories, but I adhere to the terms of the question and name really efficient outfit for a low price. I would not advise any one to purchase a lower priced outfit who intended to do anything more than play with the microscope. As to the second question, I know of no more interesting line of work than microscopical botany, and there is this advantage—that material can be had anywhere for nothing.

Outfit recommended:	
Model Stand and B eyepiece,	$25.00
Camera lucida,	1.50
Disc Eyepiece,	1.50
Double nose-piece,	5.00
Leitz objectives:	
No. 3,	6.75
No. 7,	13.50
Total	$53.25

INSTRUMENTS DESCRIBED.—I.

By the Maker.

Zentmayer's American Student Stand, Patented 1876.—Responding to our specifications on page 31, the house of Joseph Zentmayer contributes the following:



This instrument was designed and constructed with the view of enabling students to obtain an instrument combining the essential features of a first-class stand, superior optical qualities, and extremely low cost.

The instrument is of brass, with the exception of the base, which is of cast-iron, neatly japanned. The base is of one piece and very rigid, to which the bell-metal bar is attached by a joint, allowing the use of the instrument at any angle of inclination, perpendicular and horizontal positions being indicated by stops.

The coarse adjustment for focus is accomplished by rack and pinion.

The fine adjustment is of the same style as that of the American Centennial stand. A concealed lever is acted upon by a micrometer screw, and moves the entire body, which is fitted to the grooved bar, giving steady and delicate movement.

The plane and concave mirrors are hung in a plane with the object, and may be swung over the stage for illuminating opaque objects (instead of the bull's-eye condenser), having the object as the centre.

The stage is broad and firm, is only three (3) inches from the table, and is provided with delicate spring-clips, which may be removed if desired.

The diaphragm is circular in form, with a series of different size apertures.

38. American Student stand, with 1 eyepiece (A or B), 1-inch objective, 19°; 1-5 objective, 75°; walnut case, with lock and handle, ... $46.00

39. American Student stand, with 1 eyepiece, and walnut case, with lock and handle, . . . 30.00

Zentmayer's American Student Stand.

This stand is the same as No. 38, except that the coarse adjustment is accomplished by sliding the body-tube in a cloth-lined outside tube, which gives an exceedingly smooth and delicate movement.

38B. American Student stand with one eyepiece (A or B); 8-10 in. objective of 19°; 1-5 in. objective of 75°; walnut case, with lock and handle, ... $38.00

39B. American Student stand, with one eyepiece, walnut case, with lock and handle, . . 22.00

extra eyepiece for Student stand, . . 5.00

Carmine.—A useful preparation is Grenacher's alcoholic borax carmine, made by dissolving borax, 4 grams, in distilled water, 100 c. c., adding carmine, 3 grams, and heating gently; 100 c. c. of 70 per cent. alcohol is then added, and the solution filtered, if necessary, before use. The sections, after staining, are tansferred to alcohol (70 per cent.) containing half to one per cent. of hydrochloric acid (sp. gr. 1.16).

EXAMINATION OF POLLEN TUBES.

By Henry Shimer, M. D.

MOUNT CARROLL, ILL.

The fertilization of plants is effected by pollen tubes which reach down through the pistil to the ovary. The pollen is carried by the wind or by gravity to the pistil and, adhering thereto, sends down a shoot to the germinal vesicle of the ovule. Unless this process takes place no seeds can mature and no plant reproduce its kind normally.

Having lost considerable time in studying the "shepherd's purse" and the *stramonium* as recommended by certain books, I at length obtained success with other plants, the knowledge of which may be of interest. Professors Goodale and Strasburger advise students to produce these growths artificially with sweetened water, and give formulæ for use with pollens of several different plants named, but these are plants not readily at our command.

Gray in his "Structual Botany," p. 283, refers to a buckwheat pistil. Several of these studies require sections to be made. This is troublesome and few undertake it.

I have had good views of pollen tubes in my studies of apple blossoms, and especially in the syringas, which gave me the longest free tubes of all. By looking among the flowers, I often found a few free pollen tubes; but when I accidentally found them in the pistils of the grasses already prepared for examination, and in the greatest number that could be wished for, it gave me an intense joy which I had never expected.

These pollen tubes are little root-like sprouts, one or more from each pollen grain. I think I usually see but one from a single pollen grain of the grasses. These tubes may be seen *in situ* on the stigmas of the cultivated grasses better than on the stigmas of any other flower that I have examined. These grasses have a very delicate, white, branching pistil. The style and its branches are pale, white, and translucent. The style divides into two branches near the little seed. There are many little branchlets on each one of these styles. They are like little limbs surrounded by tooth-like tubes or cells. These cells correspond to the papillæ on the stigma of the higher developed flowers, as the apple blossom. The stigma of the apple shows these papillæ projecting from the crown of the stigma, the lower part of the cell being imbedded in the body of the stigma. But in the grasses these spur-like papillæ stand around the branch in close leaf-like order. They are short, projecting about 25 microns or 1-1000 of an inch long beyond the body of the branch, and about

10 microns or 1-2500 of an inch in diameter. Each one of these is a single cell. The lower part, somewhat longer than the projecting part, clasps the body of the limb, reaching down to the axil of the next cell.

These surround the vascular centre of the branch. They really seem by their union to form it, making a most excellent arrangement for receiving the pollen grains. In English blue-grass these are about 20 to 30 microns, or averaging about 1-1000 inch in diameter; in orchard grass and K. blue-grass, about 30 to 35 microns. These grasses are good for studying the sprouting of the pollen grains and for tracing the tubes down the style to the ovule. Those grasses that have pale white stigmas are much to be preferred to those having red or purple stigmas.

Kentucky blue-grass blooms in May and June; orchard grass soon follows; next comes the English blue-grass, in June and July. It has a very delicate plumose, clear stigma, and makes a good study.

In the common oats I have found a stigma that offered much interest. The pollen grains are larger, 40 to 50 microns, or 1-625 to 1-500 of an inch in diameter. The "red top" is a very good grass for study. The late flowering grasses, as the Muhlenberg grasses, Panic grasses, etc., with red stigma, do not afford so good material. The common timothy is of all the very best. At the right time it gives the grandest sight among the pollen tubes that I have seen. Although timothy blooms in July, a few heads can be found until the hard frosts kill the heads.

In 1891 I mounted some pollened timothy stigmas in glycerin, though they look the best in fresh water. Dr. Stokes, to whom I sent a slide, wrote:

"Your slide of pollen tubes is most remarkable. Never have I observed pollen tubes as they are in the mount you kindly sent me. I have seen the tubes, of course, but never such an exhibition of them."

On a clear summer morning, with plenty of dew on the grass and no wind, if the timothy is in blossom, its pollen sacs will be seen hanging on the filaments at daylight, and the plumose spreading stigma, moist in the morning dew, projecting out between the palets ready to receive the pollens. As the sun shines on the pollen sacs they burst open. If now we give the stalk a gentle shake, we shall see the numerous pollen grains, dust-like, falling and floating off in the air. If the morning is windy, much of this will be blown away. We will not get a stigma well-filled with sprouting pollen grains. But when the morning is still, many more of the grains will lodge on the plume of each stigma, and because of its closed head, much more in timothy than in the other grasses. Do not disturb the head until near noon. Give the pollen grains time to sprout and the tubes time to descend the

style. I have made excellent slides at 10 A. M., or later in the day, unless it was so hot and dry as to dry up the stigmas. I get the best slides of pollen tubes just as the bloom turns purple —often by hundreds on the same stigma.

Some notes I made July 2, 1891, read thus: "The stigma was beautiful. The adherent pollen grains had developed tubes in great numbers, some just beginning to sprout, while others had already sent their tubes down the style to the ovule. The pollens lodged on the branches of the stigma, with their tubes, are easily seen with a "C" eyepiece and a $\frac{1}{2}$-inch objective. The tubes are slightly yellow tinged, and are in plain contrast with the pure white arborescent stigma. The pollen grain does not often sprout at the point of its contact with the stigma, but the tubes come out at certain points prepared by nature for that purpose— an opening in the extine through which the tube of the intine like a glove finger pushes out. As the tube pushes out I see the extine rolling out in a collar-like ring. The tube at first is like a nipple, but as it grows into a tube it hugs closely around the circumference of the pollen grain, and thus it feels for the stigma. Very often when it has appeared too far away it makes a square-angled turn after encompassing $\frac{1}{4}$ of the circumference of the pollen grain, and thus arrives at the stigmatic tissue, where it passes down over the surface of a stigmatic cell, not penetrating into it, until it comes to an interspace between the cells. Here it finds an entering point by absorbing the contents of the gland cells of the stigma through their walls without breaking the cells open. Thus it gains space to enter into the style by the application and use of the material of the cell, in its way, for its own nourishment. Sometimes the tube makes almost a complete ring around the pollen grain before it reaches the stigma, and sometimes it makes two right-angles in its course before it reaches the stigma. Each grain seems to send out only one tube. These transparent stigmas are very fine to behold when covered with the pollen grains and tubes by hundreds.

It needs a little careful manipulation to mount the stigmas, but the inexperienced will soon learn to take out the little ovule stigmas with a needle or small knife-blade. Use a well-arranged lens fixed so that both hands are free. Place it in a drop of water on the slide. After the stigma is thoroughly wet, apply the cover with a film of water spread over it with a small knife-blade. The most important thing is to get the air away from the stigma, and it may become necessary to add a very little alcohol to the water. Alcohol spoils delicate tissues by shrinking them, so apply a very little on a knife-blade dipped in the alcohol bottle. Mount in a drop of equal parts of alcohol, glycerin, and water if you choose. Having selected good specimens to preserve, place a drop of glycerin, or of liquid glycerin jelly, or of any mounting medium,

on the edge of the cover. Draw out the water with a bit of tissue-paper. The two latter media are more easily sealed in and less likely to leak than the former. Chloral hydrate water, 5 grams to the 1 oz., preserves the tissue well and will not shrink them; but it does not answer to mount in, if there is a chance for the slide to be exposed to a freezing temperature.

A SECTION OF ORANGE LEAF.

By R. H. Ward, M. D.,

TROY, N. Y.

[From Note-book A, of the American Postal Microscopical Club.]

This transverse section through the medium and adjacent portions of the blade of an orange leaf contains many interesting features, and it has taken the colors vividly in the double staining; but it is unfortunately so thick that its study is difficult and finally disappointing in some respects. Only at one end does the section taper to a little wedge thin enough to show details easily. This is an excellent example of the effect so frequently and fondly described, not many years ago, by the advocates of off-hand sections which, being necessarily cut too thick and also uneven, were believed to supply satisfactory details in the thin, wedge-like edges that were almost inevitably produced by that method of slicing. In this case, as usually, the thin shred at the end is so far the best of the whole as to make us wish that the entire slice was equally thin, and to satisfy the last unbeliever, if there is still such an one, that the day of thin, machine-cut sections has fully and deservedly come.

This is a typical and very distinct example of the prevailing constitution of leaves, which with comparatively few exceptions are bilaterally symmetrical, *i.e.*, with the lateral halves, on each side of the general axis in the centre of the midvein, essentially equal and alike; but vertically unsymmetrical, the upper and the lower portions not being similar halves or segments of any size, but differing markedly in form and constitution, and thus giving a so-called bi-facial or "dorsi-ventral" character to the leaf.

First at the top is seen, best under the 1-4th or 1-5th inch, the epidermis, of small, more or less tubular cells, without chlorophyll, that scarcely take a slight pink tint in the staining. That portion of the walls of these cells that is exposed to the external air has covered itself with a continuous filmy and colorless pellicle called the cuticle, which, though an extremely delicate and trans-

parent membrane, is of a corky character, and nearly impervious to air and moisture. This is very well developed here, as in many other evergreen leaves, to which it renders an important service in protection from atmospheric conditions. It does not take the stain here.

Below the epidermis are two tiers, more or less, of nucleated chlorophyll-bearing, columnar cells, some four or five diameters long, rather closely packed together in the "palisade" style at right angles to the plane of the surface. This dense, sub-epidermal tissue, which is well seen only in thin tip at the end of the section, constitutes nearly the upper half of the leaf's thickness. By its compactness it gives the firm texture and the dark green color to the upper side of the living leaf, and enables it to maintain an active state as an evergreen during long periods of heat and dryness.

The lower half or more of the blade is a loosely arranged, spongy, parenchyma, with much larger, thin-walled cells of irregular forms and sizes, with rounded outlines little flattened by crowding, and easily permeated by air on account of the numerous intercellular spaces thus remaining. Near the bottom the cells are smaller and more compact, and therefore polygonal, forming a moderately dense hypodermal tissue, and covered below by an epidermis and cuticle, which are not so well developed as those of the upper surface. * * *

The fibro-vascular bundles which constitute the framework of the leaf are, where they happen to be cut transversely, finely displayed by the yellowish-green staining; and with their abundance of large ducts and of very thick-walled fibres they are seen to be remarkably adapted to the two objects of the structure—the firm support of the blade, and the rapid transmission of sap. Several dashes of green staining, at many points along the centre of the thickness of the blade, indicate spreading fibro-vascular bundles of unequal degrees of perfection, from well-formed bundles to mere hints of the same; and at various degrees of obliquity, from longitudinal to nearly transverse. The longitudinal, which should be most instructive, are badly handicapped by being buried in such an excessive thickness of section; the oblique are showy, but so confusing that it is difficult to make out anything accurately about them—a fact which is common to oblique sections generally, and which has caused them, though showy and formerly popular, to fall into disuse.

One of the most attractive and profitable experiences for a beginner in microscopy is to cut sections of various fresh leaves, and examine them carefully in water under a cover-glass, if not supplied with many permanent mounts, looking for the various features above described, and noting how they vary in different plants.

PREPARING DRUGS FOR EXAMINATION.

By A. F. Rogers.

Fresh vegetable tissues often cannot be sectioned without previously being hardened. But this may be accomplished by soaking them for 7 to 10 days in pure methylated spirit. This should be changed every day and until all color has ceased to appear. Preserve in alcohol until the tissues are wanted for sectioning.

But frequently drugs are dry and very hard; they must then be softened by soaking in water with a little methylated spirit, or even soaking in hot water. Sometimes a three per cent. solution of potassa can be safely used—that is, in cases in which the cell contents, being injured, unfit the section for examination.

To make sections of soft stems, ovaries, etc., by hand, take the specimen between the thumb and forefinger of the left hand, hold the finger horizontally so that its upper surface may form a table on which the blade of a razor may slide, keep the handle of the razor in a line with the blade, and draw it from heel to tip through the specimen and towards yourself; keep the blade well wet with very dilute alcohol, and float off the sections as they are cut into a saucer of water.

The drug is, however, frequently too hard for section-cutting by hand; it is then necessary to use a microtome. The Army Medical Museum pattern is more frequently used in this country. This is simply a brass well, into which fits a very finely cut screw. The instrument having been firmly fixed to a table by means of a clamp screw, the specimem is imbedded in a piece of carrot, or in a mixture of lard and hard paraffin; the whole is put into the well, and, as the screw is turned and gradually pushes out the whole of the contents of the well, sections are made with a razor or section knife. This is nothing more than a large razor without a handle. The knife and specimen should be kept well wet with dilute alcohol, and the sections may be kept until wanted in slightly diluted spirit.

It is not necessary to use rectified spirit in section preparing, but the methylated spirit must not contain any kind of gum. A rough-and-ready test of the fitness of the spirit is to pour it into water; it should not affect the brilliancy of the water in the slightest degree. For very friable tissues a special treatment is required. First, soak the drug in strong alcohol, then in ether. Now prepare a solution of celloidin in equal parts of alcohol and ether, about the thickness of glycerin (reserve one-third of this solution). To one-third of this solution add its own bulk of alcohol and ether in equal parts, and to the remaining one-

third add twice its bulk of alcohol and ether in equal parts. Take the tissue out of the ether and put into the thinnest of the above three solutions for a few hours, then transfer to the thicker one for three or four hours, and, lastly, to the thickest for a day; take out and dry in the air, and place in spirit until quite hard and opaque. It can now be easily cut.

The sections will be much more easily examined if they are stained one or more colors, and if they are to be stained they must usually be first bleached. First, wash out the spirit by placing in water, and then bleach by soaking in *liquor sodæ chlorinatæ* for from two to ten hours. When all the color has disappeared from the sections, wash them in water three or four times at least. They can now be kept in spirit until required.

Judson's dyes were at one time used for staining these sections, but now specially prepared stains are more generally used, which can be bought, or made if more than a very small quantity is required.

The spirit should be first washed out of the specimen. It should then be immersed in the staining fluid for from three to ten minutes, and washed in spirit for from ten to fifteen minutes. Lastly, the section, which now presents a dull appearance, is cleared by placing in some clove oil until it sticks in (usually about five minutes): it will then be found to be quite clear, and ready for mounting in Canada balsam, or, more conveniently, in a mixture of Canada balsam and one-fifth its bulk of pure turpentine.

The brightness of a section stained with borax-carmine is increased by placing it in a mixture of spirit and one-sixth its bulk of hydrochloric acid for a minute or so. The acid must afterward, of course, be thoroughly washed out.

If a section is over-stained it may be remedied by placing it in a dilute spirituous solution of hydrochloric acid, or dilute aqueous solution of acetic acid, according to the stain used.

Double staining is accomplished by using alkaline and acid solutions respectively: for example, green and red, by first placing in an acid green solution, washing with water and then placing in borax-carmine solution; then wash in spirit, and clear in olive oil.

Clove oil is a very good clearing medium and a very good vehicle in which to preserve the sections until required for mounting, if it is intended to mount them in Canada balsam. If a specimen is stained before it is sectionized it must, of course, be left in the stain hours, and perhaps days, instead of minutes. This is only done with soft tissues, such as ovaries, which should be gathered before they are quite ripe. Fresh stems should not be more than three years old as a general rule.

Sections must not be bleached where there are cystolithes or

any other cell contents which the bleaching fluid would dissolve. Certain resinous drugs, such as pellitory, must not be mounted in Canada balsam, which would dissolve out the resin; in such cases glycerin jelly, containing carbolic acid, arsenic, or some other preservative, should be used. This is best used, not with a rod, but filtered, while hot and liquid, through cotton wool directly onto the slide. To keep glycerin in is a very difficult matter. Gold size which is at least ten years old and quite "tacky" or sticky is a very good cement, but it should be touched over about every five years.

Certain black cements are very liable to run into the Canada balsam and spoil the sections.

VEGETABLE STAINS.

[From Pharmaceutical Journal and Transactions.]

Hæmatoxylin.—The formula for Ehrlich's ammoniated hæmatoxylin is: Hæmatoxylin, 2 grams, and ammonium carbonate, 0.4 gram, are dissolved in proof spirit, 40 c. c., and exposed to the air in a shallow dish for 24 hours. The volume is then made up to 40 c. c., with proof spirit, which is warmed, if necessary, to dissolve any separated crystals. Ammonia alum, 2 grams, dissolved in distilled water, 80 c. c. is then added; together with glycerin, 100 c. c., rectified spirit, 80 c. c., glacial acetic acid, 10 c. c. The solution is ready to be diluted for use straight way and does not deteriorate by keeping. Sections when stained with it are of a violet color, but this may readily be changed to blue by washing in an aqueous solution of sodium bicarbonate ($\frac{1}{2}$ grain in 1 ounce). As soon as the color is satisfactory, the sections should be transferred to 70 per cent. alcohol, for if kept in water the color is apt to fade. Over-staining may be remedied by the addition of one-tenth to one half-per cent. of strong hydrochloric acid to the alcohol and subsequent washing with the sodium bicarbonate solution already mentioned.

Plasmatic Stains.—Alcohol must be removed from the sections by placing them for a minute in distilled water, after which they may be transferred to the plasmatic stain. To follow hæmatoxylin, this may be water, soluble eosin (1 gram in 40 c. c. of alcohol and 160 c. c. of distilled water), erythrosin (same strength as eosin), or orange (2 grams in 20 c. c. of alcohol, and 80 c. c. of distilled water). After using carmine, picric acid (1 gram in 100 c. c. of 70 per cent. alcohol) affords a suitable contrast. In each instance, afterwards wash with 90 per cent. alcohol.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

The Microscope in Pharmacy.—There is a constant progress observable in the use of this instrument in drug stores. The pharmaceutical journals are giving more and more attention to the subject. In the present number of *The Microscope* will be found an article on drug examination which we have condensed from one of our pharmaceutical exchanges.

The schools of pharmacy now see the need of instruction in microscopy and are establishing chairs devoted to that subject.

The School of Pharmacy connected with the University of Kansas is under the direction of Prof. L. E. Sayre, who contributed an article to the February issue of *The Microscope.*

Tuition in this school is free. The State, convinced of the necessity of sound training for those who stand in such close relation to the public health, has provided this school with the view of putting within the reach of all young men and young women of the State, who choose to avail themselves of its advantages, the very best instruction in the theory and practice of pharmacy. It supports the school generously from the State treasury, and looks to no pecuniary return from the students. In botany, physiology, chemistry, and physics the students of the School of Pharmacy have the benefit of the instruction of the university, and use its laboratories and collections. There are thus, besides the special pharmaceutical laboratories, two chem cal laboratories (for qualitative and quantitative analysis), microscopical laboratories (for structural botany and pharmacognosy), and a physical laboratory.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

143. What is the best method for mounting starch, pollens, etc., for the polariscope? What medium is best, and how may I keep the grains in the centre of the mount?—Novice.

Place a small drop of oil of cloves on the centre of a cover-glass, and sprinkle the starch into it. With the corner of a slip of hard, smooth blotting-paper absorb the surplus oil, add a drop of balsam, and set aside, covered from the dust, for twenty-four hours. Drop sufficient balsam on the centre of the slip, place the prepared cover, stiffened balsam side down, in the fresh balsam on the slip. Apply a gentle pressure and let the cover slowly settle against the slip.

Two or three different sorts of starch or pollen may thus be mounted under one cover; and if carefully done, but little mixing will take place. If the balsam on the cover be well hardened the group or groups will not spread at all.

144. Describe the best way of cleaning diatoms without the use of acids.—E. P. W.

Put the material in a flask with pure water; insert a cork with a tube in it. The tube should reach nearly to the water inside the flask, and extend outward a foot or more in length. Boil continuously, over a lamp, for several days, or until the diatoms may be seen to be clean. The long tube acts as a sort of condenser and returns most of the steam as water, thus serving to maintain the level of the latter with but small loss. The material may be kept boiling by the hour, without attention. A little soap added will sometimes assist in cleaning away flocculent matter.

145. What is the best way of illuminating opaque objects for examination with ½ inch to 1-5 inch objectives:—E. P. W.

A bull's-eye condenser or the concave mirror swung above the stage may be used with the lower powers. A Lieberkühn, which is a concave metallic mirror, affixed to the objective, may be used. This reflector receives the light from the mirror below, and focuses it on the upper side of the object. With the higher powers, Smith's vertical illuminator may be used. This is a reflector inclosed in an adapter which is screwed to the nose-piece of the microscope, above the objective. The reflector is a thin cover-glass and receives the light from the side, reflects it down through the objective lenses, upon the opaque surface. These instruments may be had at the dealers in optical apparatus.

146. Where can prepared sections of bone be procured? —J. I. P.

The dealers in microscopical preparations will supply such mounts.

147. An accidental pressure upon the cover-glasses of some mounts caused the medium to exude, and the covers slip down when the slide is placed on edge. What were the defects in mounting?—E. L. S.

Many mediums remain soft under the cover. All such mounts should be protected with a finish of good tough varnish around the edge of the cover.

148.—How may I compute the magnification of an object photographed with or without an eyepiece, and at different distances from the objective?—A Novice.

The easiest way to find this magnification is to remove the object after photographing it, put a stage micrometer in its place, throw the image of the lines on the ground glass, and compare them with an ordinary rule. This will give the correct magnification produced by that optical combination. To compute it more or less accurately, reckon that an inch objective will amplify 10 diameters at 10 inches from its optical centre. If an inch eyepiece is used, multiply again by 10; other objectives, eyepieces, and distances in proportion.

Nelson's formula is, $\frac{DO}{AB}$ = magnification. A = focal rating of eyepiece. B = focus of objective. O = optical tube length (from optical centres). D = distance from object to eye or ground glass. As eyepieces and objectives are rarely rated correctly, computation by any rule will give approximate results only. See *A. M. M. J.*, vol. vi, page 141.

SCIENCE-GOSSIP.

Specific Stains.—Carmine, hæmatoxylin, and most of the anilin dyes stain unaltered cellulose, whilst lignified tissue may be permanently stained with methyl-green (0.25 gram in 20 c. c. of alcohol and 80 c. c. of distilled water). Squire's process for double staining stem and root sections containing cellulose and lignified tissue is to first rinse in distilled water, then place in methyl-green solution for 3 or 4 minutes; again rinse in water, wash in 90 per cent. alcohol for 5 or 10 minutes, place in Grenacher's alcoholic borax carmine for 15 or 20 minutes, rinse quickly in water, and pass through 90 per cent. alcohol. Chlorzine iodine colors cellulose blue, and lignin yellow or yellowish

brown. the latter being also colored red with phoroglucin (1 gram in 20 c. c. of alcohol and 80 c. c. of distilled water) and strong hydrocholic acid, and yellow with anilin chloride (2 grams in 65 c. c. of alcohol, 35 c. c. of distilled water, and 2 c. c. of strong HCl). Hoffmann's blue or eosin is specially useful for distinguishing sieve areas.*

Gum Thus.—Gum thus, or frankincense, is obtained from the tree of the pine. I procure it from the L. R. Barnard Chemical Co., dealers in dye-stuffs, chemicals, acids, oils, etc., at 58 Market street, Newark, N. J. I dissolve it in commercial alcohol with moderate heat, and then pour it off from the sediment. To this, three parts, I add one part of oil of cinnamon. It is used like Canada balsam, but dissolves in weak ammonia, alkali, carbonate of ammonia, soda or potash or borax. These, can be used to clean the slides from superabundant medium. Those who have tried it speak in flattering terms of it. It is of a high refractive index, makes diatoms come out well with an ordinary one-fifth, and resolves the *Amphipleura pellucida* with a one-twelfth immersion. The color, lightish brown, is bad, but I will bleach it by and by. Cholorine does not bleach it well.—*Arthur M. Edwards, M. D., Newark, N. J.*

RECENT PUBLICATIONS.

Medical Microscopy. By Frank J. Wethered. 12mo. Phila, delphia. P. Blakiston, Son & Co., 1892. pp. 406-cuts 101.

A book so clear and consise as this, so compact and so essential to the practitioner, ought to sell by the hundred thousand. How a physician of to-day can practice medicine intelligently without using a microscope continually passes our comprehension. The examination of urinary deposits, of fæces, of sputum, of vomit, of blood, of genital discharges, of cutaneous parasites, of suspected food and water, not to mention tumors, tissues, and nerves are all necessary to a proper understanding of the cases daily presented to the physician. What can be seen with the microscope and how to see it are fully set forth by the author. Of elementary microscopy, there is perhaps enough to enable the novice to begin the use of an instrument. There are chapters on hardening and decalcifying, on imbedding, on cutting sections, on staining, on clearing and mounting, on the construction and use of microscopes and accessories. Bacteriology gets a chapter at the end of the volume. We hope to arrange to furnish this book to our subscribers at a reduced rate.

* Schulze's solution: prepared by evaporating 100 c. c. of liq. zinci-chlor. B. P. to 70 c. c. and dissolving in it 10 grams of potassium iodide. Add 0.2 gram of iodine and shake frequently until saturated.

THE MICROSCOPE.

MAY,

1893.

NUMBER 5. (NEW SERIES.)

OUTFIT AND WORK FOR BEGINNERS.

BY H. L. OSBORN,

SAINT PAUL, MINN.

For the majority, I should recommend a good low-power objective, say $\frac{2}{3}$, and a stand to which could be added later a good $\frac{1}{5}$-inch.

The Bausch & Lomb Continental A stand costs $18, and the $\frac{2}{3}$-inch objective $7—total, $25. When you buy the $\frac{1}{5}$-inch objective it will cost $15 more. The B. & L. Library stand ($10) and 1-inch objective ($16) is capable of good work. I should say that microscopes of about that grade are the cheapest that are worth having, and I should advise buying the Continental in preference to the Library.

When you have secured the instrument, practice mounting and preparing objects, at first dry or in water, then in permanent mounts in glycerin jelly or balsam. Examine netting, bolting cloth, and other fabrics in order to decide in which direction the strands run. Examine paper and felt. Study the surface of every kind of leaf. Examine seeds, pollen, petals of flowers, and other floral organs. Make cross-sections of plant stems at various levels. Kill insects with chloroform; examine them whole and also the separate parts. Acquire skill by practice in preparing these things for examination. Search in water, especially salt water, for small animals and plants to examine.

All sorts of hair, scales, feathers, sand, clay, powdered minerals, etc., are interesting for low-power study. It is surprising how much can be done even with a low power or a hand-lens.

Get some book like Stokes' Microscopy for Beginners, and look up in it the explanation of what you see and the list of things which you ought to see in each kind of specimen. So far as possible, make notes and drawings of what you see. Of course, a child of ten years of age cannot do these things without a little instruction, but many young people, such as the members of the Agassiz Association, can become quite proficient with practice.

A Mounting Outfit.—The following outfit is sufficient for general microscopical work, not including section-cutting; and while it may be procured from the dealers all ready for use and even packed in a box, one can often make a considerable saving in money by collecting the items himself.

1 Turn-Table.
1 Pair Cover Forceps.
1 Knife.
1 Pair Steel Forceps.
2 Needle-Holders, Bone Handle.
1 Pair Scissors.
1 Nest of Saucers.
6 Dozen Glass Slips.
¼ Ounce Circles, assorted.
¼ " Squares, "
1 Dozen Block Tin Rings.
1 " White Metal Rings, Beveled.
1 " Ebonite Rings.
100 Square Labels.
2 Camel's-Hair Brushes with Handle.
½ Dozen Spring Compressors.
1 Brass Table, with Lamp.
1 Dropping Bottle.
2 " Tubes.
2 Dipping Tubes.
½ Dozen Watch Glasses.
1 Wide-Mouth Jar.
1 Bottle of Pure Glycerin.
1 " Oil of Cloves.
1 " Absolute Alcohol.
1 " Magenta.
1 " Methyl A, Green.
1 " Pure Benzole.
1 " White Zinc Cement.
1 " Gold Size.
1 " Brunswick Black.
1 Tube Canada Balsam.
1 Capped Bottle of Balsam.

INSTRUMENTS DESCRIBED.—II.

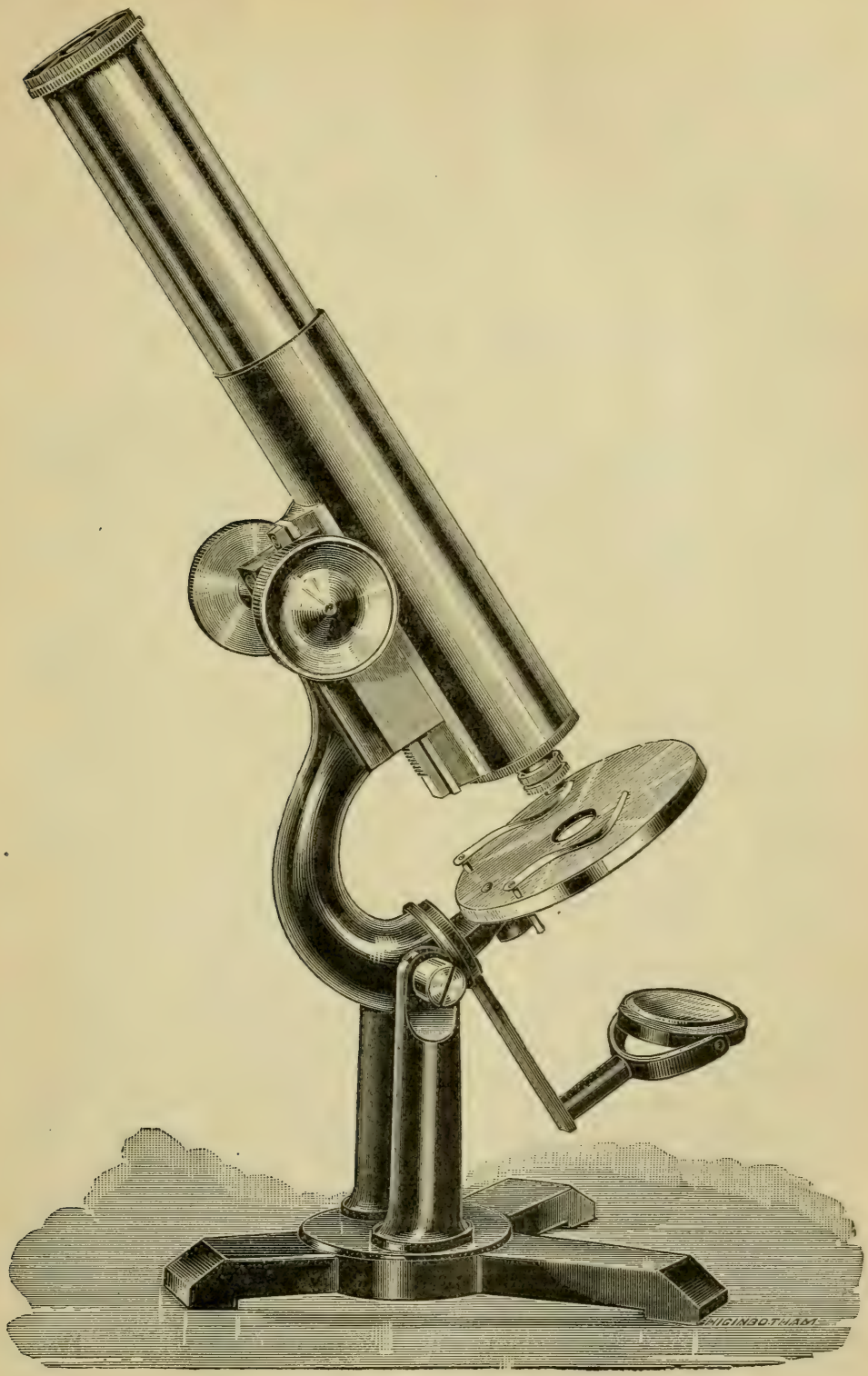
By the Maker.

The Library Microscope.—The Bausch and Lomb Optical Company of Rochester, N. Y., wrote as follows:

"We believe that our Library Microscope with society screw, equipped with 1-inch eyepiece, 1-inch objective, will meet the wants of the Agassiz Association, and other young people, as the power is sufficiently high for beginners in natural history; and, as you say that price is an object, we believe that it will meet with your wants as such. You will find the above outfit (stand, eyepiece, and 1-inch objective) listed in our catalogue as D 1, which we will be pleased to furnish at $16.00, as listed in our catalogue. The Library Microscope equipped with 2-inch eyepiece, 1-inch and ¼-inch objectives, we can offer at $30.00.

"We, in all cases, however, recommend a microscope to which at any time the possessor can attach accessories, and would therefore recommend our Model Microscope, it having a coarse and fine adjustment, also substage, which would be preferable. The party owning it would not have to exchange it later for one having these attachments. We would be pleased to furnish a Model stand, with 1-inch eye-piece and 1-inch objective, for $31.00.

The Library stand has a draw-tube and society screw. The eyepieces are of Continental pattern; the mirror concave, swings so as to give oblique illumination, or can be brought above the stage for illumination of opaque objects. The stage has spring clips. The rack-and-pinion adjustment is delicate and suited to high power objectives."



Bausch & Lomb's Library Microscope.

A DEVICE TO TAKE THE PLACE OF THE CAMERA LUCIDA IN MICROGRAPHY.

By Henry G. Piffard, M. D.,

NEW YORK.

The art of micrography, or the reproduction on paper of images of minute objects seen through the microscope, may be practised in various ways.

Some time since, it occurred to the writer that the practice of micrography could be greatly simplified by adopting the principles employed in ordinary projection, as used in connection with the optical lantern, the projection microscope, photography, etc. It was only a question of reflecting the projected image onto a piece of drawing paper fixed in some convenient position. To this end, I requested Bausch and Lomb to mount a right-angled reflecting prism with a short tube extending from one of its square faces, this tube to be of such calibre that it could be inserted into the microscope in the place of the eyepiece. From the other square face a similar short tube extends, capable of receiving the ocular and holding it firmly.

When preparing to use this device the object is placed on the stage, and focused in the usual manner. The microscope is then brought to a horizontal position, the eyepiece is removed, and the prism case put in its place, the ocular being inserted in the short tube provided for its reception. The ocular should point downward. The lamp or other source of light should then be disposed in such a way that it properly illuminates the object to be examined, it being expressly understood that no light shall escape toward the observer except that which first reaches the object. A Beck lamp is conveniently adapted to this purpose. If a piece of drawing-paper is placed beneath the ocular, and the room darkened, a brilliant image will be projected on the paper, and its reproduction can be easily accomplished with a maximum of rapidity and a minimum of discomfort. In guiding the pencil the draughtsman uses both eyes, and his spectacles if needed, and sits in whatever position he finds most comfortable. With a proper lamp, and careful utilization of its light, this device gives excellent results, with amplification up to four or five hundred diameters. If a sensitive photographic plate be substituted for the drawing-paper, an exposure of a few seconds will impress an image that may be developed in the usual way.—*New York Medical Journal.*

MODELS FOR CONSTITUTION AND BY-LAWS OF A MICROSCOPICAL SOCIETY.—I.

WASHINGTON, D. C.

This Society was organized February 5, 1884, at a meeting of the original members held in the Principal's room, High School Building, then held its meetings at No. 1321 F street N. W., and now meets at 714 13th street N. W. It was incorporated Oct. 19, 1892.

CONSTITUTION.

SECTION I.

ARTICLE 1.—*Name.*—This Society shall be known as THE MICROSCOPICAL SOCIETY OF WASHINGTON, D. C.

ART. 2.—*Object.*—The object of this Society shall be the cultivation and advancement of Microscopical Science and the mutual benefit of its members as students of the same.

SECTION II.

ARTICLE 1.—*Membership.*—There shall be three classes of members: active, corresponding, and honorary.

ART. 2.—*Active Members.*—Only practical microscopists shall be eligible to active membership. All applications or proposals for membership shall be in writing, endorsed by two members, *and accompanied by the entrance fee.* They shall be read and referred to the Committee on Membership. Said committee shall report at the next meeting of the Society for or against the admission of the candidates. A ballot shall then be taken and three negative votes shall constitute a rejection. After election the applicant shall sign the constitution.

ART. 3.—*Corresponding Members.*—Any microscopist, not a resident of the District of Columbia, who may desire to become connected with the Society shall be eligible to corresponding membership. Active members of the Society who shall remove from the District of Columbia may, upon application, be transferred to the list of corresponding members, provided they are not in arrears to the Treasurer of the Society.

ART. 4.—*Honorary Members.*—Any person eminent in science, or any person who has been the means of rendering material aid to this Society, shall be eligible to honorary membership.

ART. 5. Corresponding and honorary members shall be elected in the same manner as provided for active members, but they shall not be entitled to the privileges of voting or holding office, and shall be exempt from dues and assessments.

SECTION III.

ARTICLE 1.—*Officers.*—The officers of this Society shall consist of President, Vice-President, Corresponding Secretary, Recording Secretary, Treasurer and Curator.

ART. 2.—*Elections.*—Officers shall be elected annually, by ballot, at the first meeting in October, to enter upon the performance of their duties at the next meeting.

ART. 3.—*Committees.*—All committees shall be appointed by the Chair, unless otherwise determined. Standing committees of three or more members each on Membership and Essays shall be appointed at the next meeting after election, to serve until their successors are appointed.

SECTION IV.

ARTICLE 1.—*Amendments.*—Any amendment to this Constitution shall be proposed and submitted in writing, and read by the Secretary at a regular meeting of the Society. It shall not be voted on until the next regular meeting, when it shall be again read, and an affirmative vote of two-thirds of the members present shall be required for its adoption.

BY-LAWS.

ARTICLE 1.—*Meetings.*—Regular meetings shall be held on the second Tuesday of each month at 8 o'clock p. m., except during the months of June, July, and August, when the regular meetings shall be omitted. Special meetings shall be called by the President upon the written request of three members. Notice by mail of all meetings shall be given to all active members at least twenty-four hours prior to the time of such meeting.

ART. 2.—*Entrance Fee and Dues.*—The entrance fee shall be one dollar. Dues shall be two dollars per annum, payable semi-annually in advance. When the dues of any member shall be in arrears to the amount of five dollars his attention shall be called to the fact by the Treasurer. Failing to cancel his indebtedness within thirty days after notification by the Treasurer, the latter shall report the fact to the Corresponding Secretary, who shall thereupon notify the delinquent member that his name has been dropped from the rolls of the Society.

ART. 3.—*Duties of Officers.*—The officers shall perform the duties usually assigned to them in associations of a similar character.

ART. 4.—*Quorum.*—Five active members shall constitute a quorum for the transaction of business.

ART. 5.—*Amendments.*—These By-Laws may be amended in the same manner as provided for amendments to the Constitution.

But any one or more sections may be suspended for one meeting by a vote of two-thirds of the active members present, and the regular order of business may be suspended by a majority vote at any meeting.

ART. 6. All slides, belonging to the Society, which may be in the possession of members shall be returned to the rooms of the Society at or before the meeting immediately preceding the annual Soirée.

ORDER OF BUSINESS.

(1) Reading of minutes of last regular meeting. (2) Reading of minutes of special meeting. (3) Proposals or applications for membership. (4) Reports on candidates for membership. (5) Balloting on candidates for membership. (6) Reports of special committees. (7) Unfinished business. (8) New business. (9) Reading of papers. (10) Discussions. (11) Exhibition of slides. (12) Adjournment.

If the Society is to hold property and will need to defend its property rights, the following form is recommended:

ARTICLES OF INCORPORATION.

TO ALL WHOM IT MAY CONCERN:

This is to certify that we, whose names are hereto signed, are persons of full age, citizens of the United States and a majority of whom are citizens of the District of Columbia, have associated ourselves together, pursuant to the provisions of Section 545, Chapter 18, of the Revised Statutes of the United States relating to the District of Columbia, approved June 22, 1874, and the amendment thereto, approved April 23, 1884, under the corporate name of "THE MICROSCOPICAL SOCIETY OF WASHINGTON, D. C."

This Society is to continue for twenty years unless sooner dissolved according to law.

The particular business and objects of the Society are:

"The cultivation and advancement of Microscopical Science and the mutual benefit of its members as students of the same."

The affairs of this Society shall be managed by the undersigned and such persons as may be hereafter elected members of said corporation through duly elected officers, consisting of a President, Vice-President, Corresponding Secretary, Recording Secretary, Treasurer, and Curator.

The said officers shall be chosen by ballot at the regular annual election of the corporation, at such time as may be fixed upon by the By-Laws of this corporation.

The officers or managers for the first year of its existence are: (Names follow.)

In witness whereof we have hereunto set our hands this 18th day of October, A. D. 1892. (Names follow.)

DISTRICT OF COLUMBIA, }
COUNTY OF WASHINGTON, } *ss:*

Be it remembered that on this 18th day of October, 1892, before the subscriber personally appeared the above-named (insert names), to me personally known and known to me to be the persons whose names are subscribed to the foregoing instrument of writing, and severally and personally acknowledged the same to be their act and deed for the uses and purposes therein set forth.

Given under my hand and official seal the day and year above written.

JOS. H. BLACKWOOD,
[SEAL.] *Notary Public, D. C.*

THE PRICE AND COMPOSITION OF FARRANT'S MEDIUM.

BY CHAS. W. SMILEY,
WASHINGTON, D. C.

One of our Western subscribers recently propounded a query which we have submitted to the dealers, with some rather interesting results. He demanded to know why dealers charge 50 cents per ounce for Farrant's medium, or why any one pays it when he can buy the ingredients at a drug store for less than 3 cents. (Picked lumps gum acacia, 4 drams; glycerine, 2 fluid-grams; camphor water, 4 fluid-grams. Mix, let it dissolve and strain.)

Dr. Shanks has already replied that Farrant's medium, made as suggested by F., would probably be thick and gummy, spoil the mounts, and so not be worth even 3 cents per ounce.

Bausch & Lomb make the following very satisfactory reply:

"Farrant's medium, as quoted in our catalogue, is a compound prepared after a carefully selected formula, which consists of several ingredients, and undergoes a process of preparation that is time-consuming. Hence the price."

But from several other dealers we received replies marked "confidential," and not to be printed. And yet some good ideas came along which there is no harm in printing on our own responsibility. One dealer said:

"Your correspondent appears to have overlooked the great element of cost in all articles of trade, viz., time and division of quantity. If he would order a pint in bulk instead of an ounce we would be able to charge a less rate. How would F. answer

this question: Why do slides sell for 50 or 75 cents when the glass and other materials cost only 3 to 6 cents?"

Another dealer whom we esteem very highly said that he would not answer an anonymous query and he could see no benefit to himself in answering it under any circumstances. But he added in postscript that he had never heard of making Farrant's medium in accordance with F.'s recipe, and that he was sure it did not originate in a standard text-book. Still another dealer, who declined "to enter into any published controversy on the subject," wrote the following very reasonable reply:

"We do not see what is to prevent F. or some other person, if we answer this question, from continuing to propound questions of a similar nature; for instance, the question might be: How is it that we charge 75 cents for mounted specimens of Bacillus tuberculosis when the slide only costs one (1) cent and the cover costs less than a cent and the bacilli costs nothing? In other words, the whole thing costs two (2) cents, and we charge 75 cents for it according to this theory.

"Again, why do you charge $3.00 for a slide cabinet when the lumber in the cabinet is worth less than 20 cents? Of course, it is needless to explain to such people that it is necessary to pay for labor, and that dealers must pay rents, etc. The more you say, the less they believe. If F.'s idea of analyzing the prices on microscopical material was pushed to the extreme there would be no use in our advertising our goods in the microscopical journals or by other means, as it can always be clearly proven that where a man has knowledge he can, as a rule, make up a microscopical preparation cheaper than the dealers can sell it, and if all the microscopists made up their own preparations there would be no use in the dealers advertising their goods."

F. takes no account of the bottle, nor of the skill, nor of the time consumed, nor of the need of profits. Yesterday I paid a dentist $2 for an hour's work in cleaning my teeth. Why did I not do it myself? We pay doctors for advice and for recipes which can be found in the books and medical journals.

Carpenter on the Microscope gives this: Farrant's medium is made by dissolving 4 parts of picked gum arabic in 4 parts of cold distilled water, and then adding 2 parts of glycerin. The solution must be made without the aid of heat, the mixture being continually stirred, but not shaken. Afterward the liquid must be strained through fine cambric, previously well washed out by a current of clean cold water. Keep in a glass-stoppered bottle containing a small piece of camphor.

And now we have only to add the request that subscribers who try F.'s recipe or Carpenter's and succeed with it will write to us the results for the benefit of others who feel inclined to economize their money and use their time in this manner.

ON THE DARK ROOM AND ITS FITTINGS.

By F. W. Mills,
HUDDERSFIELD, ENGLAND,
Author of An Introduction to the Study of the Diatomaceæ

[From "Photography applied to the Microscope," pp. 38–40.]

Although development may be carried out in the bed-room at night, or in a cupboard, under stairs, or in the wine-cellar, and such places, these are obviously inconvenient and quite unsuitable to any systematic scientific work being done. A room should be fitted up especially for the purpose, and the most convenient is to convert at will the room in which the apparatus stands into the dark room—in other words, make the dark room of such size that the apparatus can be kept in it.

The room should be well ventilated, this being a very important item, as when artificial light is used the air gets foul, especially when ammonia is being used. It should also have a good water supply, and a sink, over which development can be done.

Illumination.—Gas is the most convenient when it can be obtained, one jet being provided with a by-pass, the pilot flame of which burns behind a collar, thus showing no light when turned down. This does to illuminate the room on ordinary occasions, and for exposing bromide prints, etc. Another jet is placed inside a lantern glazed with ruby glass; the screen-holding glass being removable and replacaeble with one of yellow, for use during printing or the development of plates other than orthochromatic. If gas is not available, paraffin lamp or candles must be made to suffice; but these are not so generally useful as the gas, the heat from it being easily used as a means of vetilating the room. The flue from the lantern should be led out of the room. A set of half a dozen dishes of porcelain will be found sufficient. Two or three shelves ought to be fitted up to hold the bottles of reagents. The reagents required and the strengths convenient for photographic use are as follows:

Pyrogallic acid, 10 per cent.; bromide potassium, 10 per cent.; ammonia, 10 per cent.; potass. ferrocyanide, 10 per cent.; quinol, crystalline; potass. hydrate, in sticks; potass. metabisulphite; sulphite of soda, crystalline; citric acid, crystalline; ferrous sulphate, sat. sol.; neut. oxalate potass., sat. sol.; mercury perchloride, sat. sol.; thiosulphate soda (hypo), sat. sol.; powdered alum, sat. sol.

The first three substances on the list are most conveniently kept in dropping-bottles of about two to four ounce capacity, the alum and hypo being kept in stone jars. Two measuring glasses should be obtained, one of ten-ounce capacity and another of one drachm. A pair of small balances with glass pans are also required. The fixing bath should have a wooden lid to prevent dust falling in; it also prevents evaporation when not in use.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

A Great Change.—From 1881 to 1892 two American microscopical periodicals struggled along on the same plane, both fearing continually to lose advanced subscribers by catering to beginners, and dreading equally to lose their less advanced patrons because of the matter being too abstruse or "too scientific." Now, the MICROSCOPICAL JOURNAL will not hesitate to publish the most abstruse contributions to microscopy and biology. It will epitomize the information of permanent value in this science. It will not cater to beginners. THE MICROSCOPE, on the contrary, endeavors to publish nothing but what everybody can comprehend, even the 15-year-old boys, of whom several are now subscribers, as well as the people, who, while not scientists, wish to learn something of microscopy and to be able to entertain their children with something besides talk. Its matter will often be of temporary interest rather than of permanent value. It is for popular matter.

How to Begin.—If you know absolutely nothing about a microscope, you can buy a good instrument for from $16 to $30, and by taking THE MICROSCOPE you can learn how to entertain yourself and friends many a leisure hour. It is one of the most fascinating of recreations. You will need some objects for exhibition. See our advertisement of microscopic preparations illustrating vegetable life at about 5 cents each. Any question that you desire to ask you can get answered in our columns. We also offer the following premiums.

Premiums.—For every new subscription to THE MICROSCOPE accompanied with $1 we will give the choice of one of Sutton's slides of American woods. The money must be sent direct and not through any agent for you to secure the premium; otherwise the agent gets the premium.

OF POPULAR INTEREST: Ironwood (transverse section); Sycamore (tr. sec.); Spruce (tr. sec).

OF SCIENTIFIC INTEREST: White pine (*Pinus strobus*). long. sec.; Beech (*Favus sylvatica*), tr. sec.

For every new subscription to both THE MICROSCOPE (price $1) and the MICROSCOPICAL JOURNAL (price $2) accompanied by $3 we will give *one of each of the 5 slides free.* Or we will sell either of the slides at 20 cents each, which is the very low price put upon them by Mr. Sutton in his advertisement in the JOURNAL. All subscriptions should end with the volume in Dec.

New Societies.—To encourage the formation of new microscopical societies, we will send THE MICROSCOPE free for one year to ever charter member (not exceeding 15) who participates in the organization. The secretary is to send us a report of each meeting of the society for publication. A model for a constitution and by-laws can be found in THE MICROSCOPE for May, 1893.

Buying Your First Microscope.—In making a beginning in microscopical study you have to look forward to the future a little and anticipate future needs. If after a few months' practice you will want to increase your facilities and add to your apparatus you must buy your first instrument with that contingency in view. But, on the contrary, if you are not going to enlarge your outfit, you can save money by ignoring the future. A beginner may buy a stand in which the most powerful objectives will fit perfectly, or for far less money he may buy one useful only for the low-power objectives which come with it and which are sufficient for the needs of a beginner.

With this in view, we have addressed several dealers, asking what they can furnish for such beginners as the young people of the Agassiz Association, and have received some valuable replies. Later, we hope that all the other dealers will report what each can do for the beginner.

Most of the firms allow a discount to the editor of this periodical, which we will divide with those young people who are struggling to get a start in scientific work and who do not feel able to pay the full retail price.

Photomicrography.—I want to know something about this subject and where to buy instruments at reasonable prices. I will try it this summer. I lost all my slides and equipment lately by fire in the High School. After the new building is up we shall have an equipment of 10 stands and accessories. M. RICKER.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

149. How is collar correction managed? What are the appearances which call for opening and what for closing the systems? How can I arrive at the best correction and know that I have obtained it? If there is no certain and short cut to proper correction, it would be a satisfaction to know th fact.—Dan.

See article by Dr. S. G. Shanks in June number of *A. M. Microscopical Journal*, 1893.

150. Is methylated spirits the same as alcohol?—S.

Methylated spirits is common or ethyl alcohol with 1-9 its bulk of methyl alcohol (wood alcohol). The latter alcohol has a disagreeable, smoky taste and is unsuitable for beverages, therefore is duty free in England. Methylated spirits is also duty free and is intended for use in the arts.

151. What substitute may be used for the slide of the plate-holder in photomicrography with high powers? After careful focusing the withdrawal of the slide disturbs the focus. —W. N. S.

If the camera is steady and firm and the plate-holder fits as it should do, a careful withdrawal of the slide should not disturb the adjustments. Perhaps the objective is at fault; visual and chemical rays do not always come to the same focal point.

152. Will tobacco smoke injure microscopic specimens? Will tobacco smoke change the color of white paper?—R.

Tobacco smoke, like any other kind of smoke, is finely divided carbon or soot, and will injure any delicate objects, if in sufficient quantity. There are other volatile principles in tobacco, but not in sufficient quantities to produce any special effects.

153. Is the duty on imported microscopes 40 per cent.; and does this mean for everything in an outfit, including objectives, eyepieces, etc., or is the latter subject to separate duty? Can the duty be determined by adding the price of stand, objectives, eyepieces, etc.?—A. D. P. Weaver.

Yes, you must pay 40% on the price at which all such manufactured objects are billed to you. Not even an eyepiece can be sent in to you free of duty.

154. What is the most convenient and best method for producing monochromatic illumination? What are the formulæ for the ammonio-cupric solution and the sodium flame?—F. P.

The best method for producing monochromatic illumination is by the use of expensive prisms, as described in Carpenter, 7th ed., pp. 272 and 360. The most convenient method is by the use of cobalt blue glass. Ammonio-sulphate of copper may be made as follows: Take a saturated solution of sulphate of copper in water, add strong aqua ammonia until the precipitate at first formed is redissolved. The resulting deep blue solution, in a flat-sided tank, is placed between the source of light and the object. The sodium flame is best produced by dissolving a sodium salt (sodium salicytate or caustic soda) in alcohol and burning it in an ordinary alcohol lamp. The flame is deep yellow in color, but of very feeble illuminating power.

155. Can you give me information in regard to making microphotographs (minute photographs on glass, not the enlarged photomicrographs) or refer me to any book upon the subject?—X.

There is practically no practical literature on the subject, but a method may be worked out by an ingenious person. The following outlines of a method which has been successfully used may be of assistance: Make a small camera to take a plate, say, 1½ x 2 inches (a quarter plate cut in 4). Use a plain glass dabbed with putty for a "ground glass," to set against a strip of glass top and bottom, with spring clips to hold it. An inch objective in a smoothly sliding tube for focusing will serve as the photo lens. Have stops or pegs on the supporting-board or table, so the whole camera may be removed to the dark room, a sensitized plate slipped in place of the "ground glass," and the whole replaced in the former position; the back of the camera closes with a slide or door. If this combination camera and slide-holder is made wide enough a screw or rod through the side may be arranged to press against the plate and move it sidewise to several new positions, and thus allow of several different exposures of the same negative, the whole to be developed together and subsequently cut apart. The negative to be copied must be set up several feet away and very carefully and evenly illuminated. Focus on a prominent black band or mark painted on the negative film. Use a hand-lens to secure a sharp image. It will be necessary to make allowance for the different focal points of visual and chemical rays, unless the objective has been specially corrected for photo use. The old collodion wet process will probably produce the finer results in these minute transparencies. Development will be simply guess-work until experience is gained.

A microscope stand has been used in this way: Remove the eyepiece, direct the tube horizontally toward the illuminated nega-

tive, use the microscope stage for the sensitized plate. Either the stage or the negative and light must be enclosed in a box so no light will reach the sensitized plate excepting through the objective. The microscope tube may be thrust through a hole in a thin partition, with the stage in the dark room, when the plate may be exposed and developed.

Space will not allow a more detailed description. A person evperienced in photography.

See A. M. M. J., vol. x, page 276, for a short article.

156. Microphotographs. How are the miniature magnifying-glasses with photo views made.—Holiday.

See answer to query No. 155.

After the photo is made and cut down, a melted glass bead is cemented with balsam over the face of the picture. When hard, the edges are ground to fit the holder. The spherical bead acts as a lens. They are usually made in France or Switzerland, where labor is cheap.

157. Who will put me up a special mount of pygidium of flea?—A. L. W.

A.—Write to Eugène Bourgogne, 34 Rue du Cardinal-Lemoine, Paris, France, and enclose a United States dollar bill in registered letter. He will sell it to a broker for 95 or 98 cents. Write to him in French if you can. There will be no duty on the slide.

CORRESPONDENCE.

Rotifera.—Mr. H. S. Jennings, of Michigan University, is studying the Michigan rotifers and would doubtless like to communicate with others who are interested therein.

What Dr. Stowell has to say of the Microscope.—It will be remembered that Dr. Stowell, who founded this periodical at Ann Arbor, in April, 1881, is editor and publisher of *The National Medical Review*, at 1326 New York avenue, in this city. That he looks kindly after his offspring will appear from the following extract from the *Review* for May, though we regret to notice that he does not always correctly remember the ages of his children:

"Our first literary offspring, THE MICROSCOPE, now thirteen years of age, appears in a new dress, precisely like that of its younger brother, *The Review*. This is of course, very proper, as we now have a two-year-old at home and a thirteen-year-old in the charge of Prof. Smiley of this city. THE MICROSCOPE starts at volume 1, new series for 1893, and is especially devoted to the needs of naturalists, physicians, and druggists. The subscription price is one dollar a year. Address Chas. W. Smiley, Box 630, Washington, D. C."

Diatoms.—I have seen your question in February number (page 32) and would say:

If your question relates to the richness of earth in diatoms, the so-called fossil earth of Nice (but which we suppose to come from Sicily) contains some 95 per cent. diatoms to 5 per cent. of waste matter. If we speak from the point of view of the diversity of forms, the deposit of the fresh-water Loch Kinnord, in Scotland, is the best, as it contains 200 different species according to the list published by the Rev. Geo. Davidson, while the richest deposit of marine forms is that of Sendai, Japan, which has furnished us more than 400 species.

M. J. Tempere, Paris, France.

RECENT PUBLICATIONS.

American Monthly Microscopical Journal for March. Washington, D. C.

The following is a brief synopsis of the contents: Professor Osborn gives a biological description of certain common hydroid animals. It is an exhaustive and valuable paper. Explicit directions are given for studying the Hydra. The article is accompanied by a finely-executed plate, with explanation of the figures.

Rev. F. B. Carter gives a continuation of an exhaustive treatise on the Radiolaria. Next is an examination of terrace-dust from Calcutta, India, with description of some magnetic and hyaline spherules found therein, with cuts and explanations of same.

Microscopical technique applied to Histology. A continuation of this valuable article, with a great many explicit directions for manipulations.

Dr. Schneider, a new contributor, writes on the Contractile Vesicle of Paramæcium. This is a fine article, with cut of *Paramæcium aurelia*.

Dr. Gray writes upon the spiracles of the click-beetle (with cut).

The editorials are upon scientific names and upon newspaper trash. A note upon terrace-dust suggests a chance for amateurs to do some scientific investigation.

A wash-bottle for sections and a convenient life-slide that can be made in five minutes are illustrated and described.

Two methods are given for detecting Tubercle bacilli in milk. Explicit directions are also given upon how to mount fish-scales. Under Diatoms we have an account of Moller's test plates.

Reports of Microscopical Societies always contain valuable information, such as abstract of papers read, etc.

Two new publications upon microscopical subjects are reviewed. Titles of microscopical publications are given to be used in forming a card catalogue. This is a new feature which promises to be of much value.

THE MICROSCOPE.

———[JUNE, 1893.]———

NUMBER 6..... NEW SERIES.

MICROSCOPY IN INDIANA.

BY A. W. BRAYTON, M. D., INDIANAPOLIS, INDIANA.

The American Microscopical Society was organized and held its first meeting here in 1879. The old Indianapolis Microscopical Society held its last meeting, I think, the same year. The use of the microscope has increased yearly in our city and State since that time, but there is no society; the reason, I think, is that all interested in work now do it alone at home. I have sold, mainly as agent for Bausch & Lomb, or for Mr. Griffith when his stand was made by them, nearly $3,000 worth of stands and accessory apparatus to physicians in this city and vicinity. We have several biological laboratories in the State. Notable work has been done by Professor John M. Coulter, mainly in the years from 1880 to 1892, at Wabash College, in botanical histology and physiology. Also, since 1885, in Purdue University, by President Coulter's brother, Professor Stanley M. Coulter, in general biology; to say nothing of the work of Professor C. R. Barnes and Professor Arthur. The substantial contributions of these scientists to botany are well known the world over.

A very considerable impulse was given to embryological research in the State University at Bloomington by Professor Kingsley, formerly associate editor of the *American Naturalist.* Unfortunately for biological research in this State, Professor Kingsley only remained two years at the university. One of his most assiduous students was Dr. Robert Hessler, now demonstrator of pathology at the Indiana Medical College. His series of slides, over 3,000 in number, covers nearly the whole range of human pathology, and is one of the most valuable in the West. His knowledge of analine stains is perfect, and his preparations are very fine. Associated, also, with the work in that college is Professor Theodore Potter, professor of bacteriology. He has given a great impulse to

the study of the infectious diseases, among our medical men. The college has eighteen Bausch & Lomb stands with 3-4 and 1-6 objectives, and we are now training our students in (1) use of microscope, (2) normal histology, (3) pathology, and (4) bacteriology.

Among the notable collections of miscellaneous microscopic objects is that of Dr. Edward F. Hodges, especially rich in rare slides of Dalland, and containing the best work of that late enthusiast in diatom mounting; also, that of Dr. Frisbie Newcomer, who was a most faithful attendant of the American Association meetings up to the time of his lamented death. I am told by Mr. E. H. Griffith that Dr. Hodge's collection is the most valuable that it has been his privilege to examine.

Researches on the pathology of the nervous system have been made during the last ten years by Dr. W. B. Fletcher, the well-known alienist and neurologist, assisted by Dr. Mary E. Spink. Dr. Fletcher was the pioneer of microscope work at Indianapolis. Dr. Joseph Stillson has charge of microscopy in the College of Physicians and Surgeons of this city, where they have six of Griffith's outfits. Dr. Stillson has applied the microscope to general physiology and to his own special field, the eye. The City Hospital has an outfit costing $200, used in pathological research. The city High School has a dozen compound glasses, and uses them in laboratory work in the junior year.

Professor O. P. Hay, the well-known herpetologist, popularized the use of the microscope in biology in Butler University at Irvington, two miles east of Indianapolis, where, for ten years, he was the leading man, and an ornament to the faculty of that institution. Excellent working outfits are possessed in our city by the following physicians: Guido Bell, A. W. Brayton, S. E. Earp, E. S. Elder, F. C. Ferguson, W. B. Fletcher, J. W. Hervey, Robert Hessler, E. F. Hodges, H. Jameson, J. W. Marsee, F. A. Morrison, P. T. McShane, J. H. Oliver, H. O. Pantzer, Theodore Potter, G. W. Sloan, Sarah Stockton, W. H. Wishard, J. A. Latchiffe, Joseph Eastman, F. C. Woodburn, and of course, some few others whose possession of glasses I am not aware of. Several colleges, as Earlham, Hanover and Moore's Hill, have laboratory outfits, but which, as far as I know, have done no work known to the world, such as has been done by Professor Jordan, the eminent icthyologist, now president of Leland Stanford, Jr., University; President John M. Coulter, first of American systematic botanists, now president of our State University, and president-elect of Lake Forest University, Illinois; — by Professors Bowes, Arthur, Stanley, Coulter, Kingsley and others.

My own impression is that the balmy days of microscopical societies have been merged in general biological and other scientific societies. The glass is, after all, only an instrument; it is, particularly in medicine, a means and not an end. We do not have any telescope societies that I am aware of, but astronomy is none the less a progressive science. And so with the microscope, at least with us in Indianapolis, the parent home of the national society. We are more and more interested in biology and pathology, but the day of the glass and brass men has gone into the past—has become, in brief, ancient history.

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INSTRUMENTS DESCRIBED—III.

BY THE MAKER.

The Star Microscope.—Messrs. Williams, Brown & Earle of Philadelphia, recommend their Star Microscope, which has fine and coarse adjustments, 1-inch eyepiece, 1-inch objective, a double mirror and diaphragm, and sells at $20. The same stand, fitted with an additional objective (1-4 inch), costs $27.50. This instrument is made by R. & J. Beck, of London, and pays a duty of 40 per cent. It nevertheless sells at about the same price as domestic instruments of the same grade. The objective and eyepiece are the same as furnished with higher grade instruments. To the substage can be fitted all ordinary accessories like condenser, polariscope and illuminator. The base is filled with lead, and the stand not likely to be overturned by accident. Great delicacy of focusing is claimed for this instrument, and its fine adjustment doubtless makes it somewhat superior to all which lack a fine adjustment.

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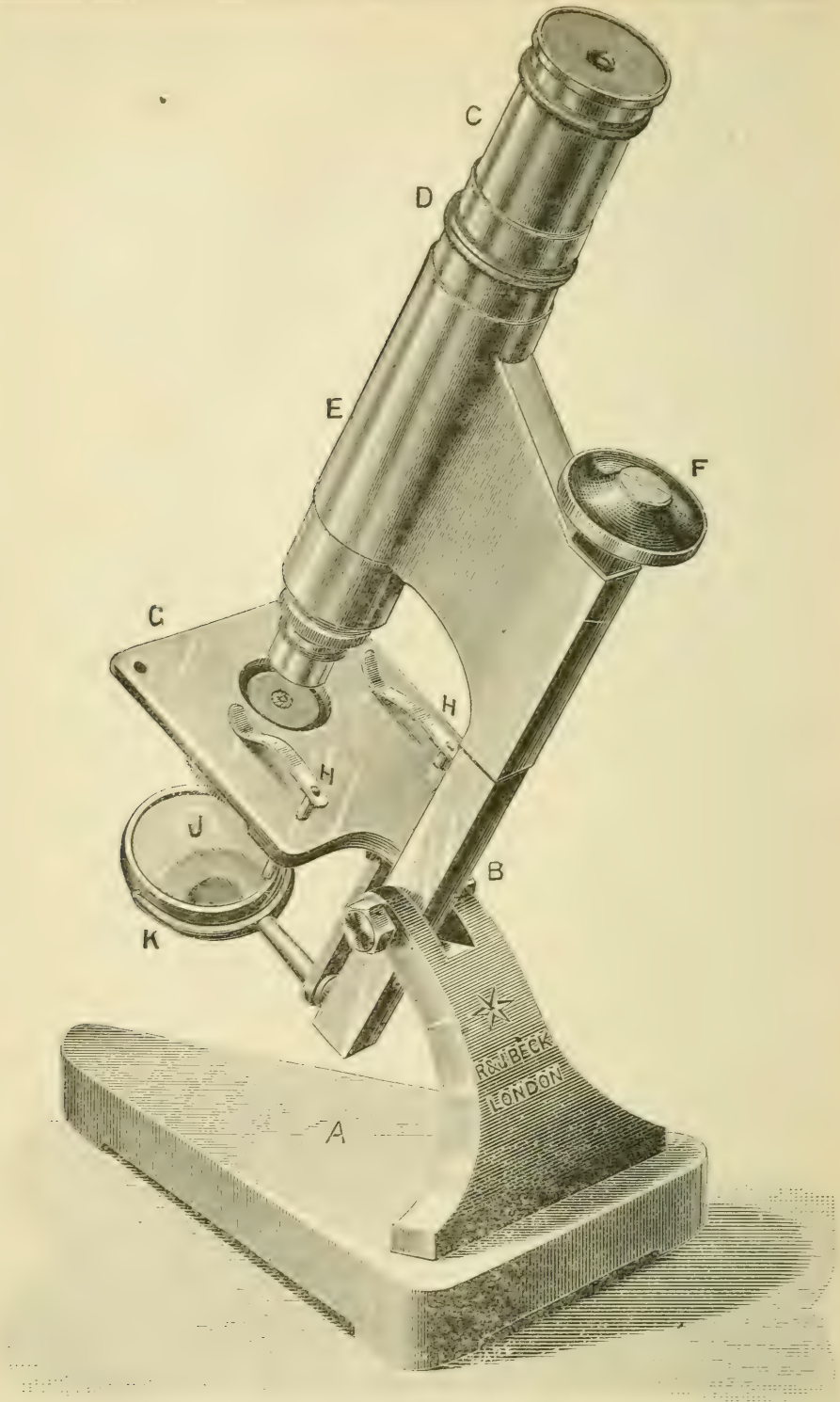
THE ADULTERATION OF DRUGS.

BY W. G. TUCKER, M. D., ALBANY, NEW YORK.

The result of a careful examination of 326 samples of various drugs was as follows: Good quality, 140, or 43.0 per cent.; fair quality, 44, or 13.3 per cent.; inferior, 79, or 24.2 per cent.; not as called for, 53, or 19.3 per cent. The latter 63 samples, designated "not as called for," show simply the fairness of the examiner, as, while containing adulterants, benefit of the doubt is given to the compounder or seller.



Williams, Brown & Earle's Star Microscope.

THE MICROSCOPE'S CONTRIBUTION TO THE PHYSICAL HISTORY OF THE EARTH.

Professor T. G. Bonney, in the Rede lectures, takes for his text the progress in geological research which has been directly due to the revelations of the microscope. By the side of the epoch-making discoveries of Darwin and Wallace, Bunsen and Kirchoff, he places the work in a humbler and more limited sphere, of Sorby, who, in 1856, first described the results of microscopic investigations into the structure of minerals and rocks. The method employed by Sorby was, strictly speaking, not novel, for, years before, in 1827, William Nicoll, of Edinburgh, had made sections of fossil wood sufficiently thin for microscopical examination. The device, however, had not been generally applied, and to Sorby is due the credit of first pointing out its wide possibilities.

Before telling the story of microscopical research into the history of the earth's crust, the author indicates briefly the mode in which the microscope is used in the examination of minerals and rocks. Slices are first cut by the lapidary's wheel thin enough for most of the minerals to become translucent, if not transparent. These are then examined under a microscope of special construction, furnished with Nicol's prisms and other optical appliances. Upon the history of the two main groups of rocks the microscope has thrown much light. For the igneous rocks it has simplified the classification and determined the mutual relations, while for the sedimentary group it has shown the true nature of their constituents and pointed out the sources from which they were derived. But it is in helping to elucidate the problem of the metamorphic rocks, of which much less was known, that the microscope has been of the most service.

The author deals at length with this portion of his subject, and shows how the microscope has assisted in the attempt to determine the history and mutual relation of these rocks. One of the most important results within the last few years has been the demonstration that without exception these crystalline schists are very old, all probably older than the first rocks in which traces of life have been found. The conclusion at present arrived at is that "the environment necessary for changing an ordinary sediment into a crystalline schist existed generally only in the earliest ages, and but very rarely and locally, if ever, since Palaeozoic time began."

The crystalline schists, then, are the relics still preserved to

us, of the early days of this earth's history, when the temperature near the surface was still very high. Since that time the zone for marked mineralogical changes has been continually sinking until at the present day it has reached a depth practically unattainable. "The subterranean laboratory still exists, but the way to it was virtually closed at a comparatively early period in the earth's history."

In conclusion the author considers that the progress made since the microscope was pressed into the service of geology augurs well for the future, and inspires the hope that we shall at least learn something of the history of the earliest ages, "when the earth had but lately ceased to glow, and when the mystery of life began."—*Jour. R. M. S.*

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A NEW MACHINE FOR CUTTING AND GRINDING THIN SECTIONS OF ROCK AND MINERAL.

BY GEORGE H. WILLIAMS, BALTIMORE, MD.

A brief description of a new machine for cutting and grinding rock sections in which electricity furnishes an economical and satisfactory motive power, may prove acceptable to the constantly increasing number of workers in mineralogy and petrography. This machine was devised for the petrographical laboratory of the Johns Hopkins University over a year ago, and since then it has been in more or less constant use.

It has thoroughly established its reputation for accurate and rapid work, while experience has suggested some improvement on the original model.

The machine consists of a substantial table carrying in its lower part the electric batteries and motor, while upon its upper surface is placed the apparatus for grinding and sawing. The table is approximately three and one-half feet square and two feet nine inches high. It is constructed, with all of its appurtenances, by the Donaldson-Macrae Electric Company (of 215 No. Calvert Street, Baltimore), whose storage batteries and electric motors are well known. The price of the machine complete is $130, consisting of the following parts: 1. Three 200-Ampere hour storage batteries, 13 inches high, in portable rubber cases. These batteries stand on a firmly-constructed cross-piece from which they may be readily removed for recharging. 2. One one-eighth horse-power electric motor of the Donaldson-Macrae pattern. This is fastened to a second

cross-piece above the batteries and below the table surface. It is provided with two pulleys from which belts pass to the shaft on the table, which carry the grinding disks and diamond saw. The grinding apparatus consists of two circular disks of solid copper 9 inches in diameter and three-eighths of an inch thick, which may be used alternately as different grades of emery are required. They are attached either by a screw or square socket to a vertical iron spindle which revolves smoothly in a conical bearing. The grinding disk is surrounded when in use by a large cylindrical pan of tin which has an opening in its centre to allow of the passage of the spindle. 4. The sawing apparatus consists of a horizontal counter-shaft placed on a different part of the table from the grinding disk and connected with the moter by a separate belt. It carries at one end a vertical wheel of solid emery and at the other an attachment, level-table and guide for the diamond saw. A small water can and spout are suspended over the level-table to keep the edge of the saw wet when it is in use.

Under some circumstances it may be found advantageous to obtain electricity for this motor by a direct wire from an electric light or power company. Considerable inquiry has shown, however, that in Baltimore the storage batteries are more convenient, safe and economical; a single charge lasts for the needs of a laboratory of ten students for a month. The batteries are removed by the electric company, and returned with little or no delay, at a cost of $3.75 for recharging.—*American Journal of Science.*

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SECTION OF RUTABAGA TURNIP.

[*From Note-Book P, of the American Postal Microscopical Club*]

BY R. H. WARD, M. D., TROY, N. Y.

This is a mass of nearly simple cellular tissue, though formed from the layers which usually produce wood, having no function but to be gorged with food-products for the future use of the plant or of its cultivator. Some of the stained nuclei show in front view as roundish discs, and others, in edge view, as lenticular thickenings of the vertical cell-walls. The absence of starch from the cells of this parenchyma is a notable contrast to its abundance in most tubers, root-stocks, etc., while

the excessive proportion of water (some 92 per cent.) in the fresh turnip, which is so obvious when it is cooked for food, may further account for the exceptionally empty appearance of these cells.

There are a few wretched fibro-vascular bundles sprawling through it at the extraordinary intervals of two or three mm. apart, the fibres which would commonly suffice for a small fibrous root being here almost lost in an enormous overgrowth of pith-like tissue. One of the bundles happens to be cut longitudinally for some distance, giving pretty glimpses of reticulated vessels.

This monotonous mass gives a key to one of the most extreme instances known to economic botany, of specialization produced by cultivation.

The turnips (*Brassica campestris, L.*), including the Swedish turnips, or rutabagas, must have been originally weedy plants of the cruciferous (mustard) family, and one variety of the same species (?); colza, or rape seed, still remains near the wild state, with a small annual root, after much cultivation for its oily seeds. They are most nearly related to the slender mustards, of pungent seeds, and to the overgrown cabbages which, like themselves, mostly run to an excessive storing of food, but in the leaves instead of the stem—only one of them, the kohlrabi, storing no small part in a turnip-like thickening of its clumsy stem. All these forms must have diverged from a common type, at no very distant time, geologically speaking, and their assignment to (our) varieties, species, and even genera, is necessarily uncertain, changeable and unsatisfactory.

The "turnip" or "turnip-root" of the gardeners is a combination, the bottom being evidently root, and the top as plainly stem, but both are so deformed into a simple lump of stored food, that it is often impossible to see, with or without the microscope, where one ends and the other begins. Probably no one could say, from this specimen, whether it was root or stem. It is, both histologically and mechanically, as poorly adapted to either as is compatible with keeping the plant together for a year and a-half. Beyond this limit everything is sacrificed to the rapid and economical storing of food. Nor is it any longer a storing for next summer's use of the plant, in producing a vast crop of flowers and seeds, for the development has been forced by cultivation to a degree far beyond that which is useful or safe for the plant even under the most favorable natural conditions; but to the farmer, instead, when protected by his fostering care, it furnishes a greater amount of food for man and beast than can be got from

the same amount of ground, and at the same cost of labor, in almost any other way.

Such excessively high-bred varieties are, of course, very sensitive to surrounding influences. They thrive best in light, rich, loamy soils, and in moist, equable climates, as notably in some portions of England. In poor soils they speedily degenerate into a weedy and acrid state; while liberal use of suitable manures has been known to raise their yield from two up to twelve tons per acre. They are, likewise, comparatively helpless against foreign attacks, becoming the easy prey of the turnip-fly and beetle; whole fields being often blighted, almost at once, by mildew fungi (*Peronospora parasitica* and *Oidium balsamii*). Nearly all these points will be found explained, or at least hinted, in the very simple object on the slide.

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ON ILLUMINATION FOR PHOTOMICROGRAPHY.

BY F. W. MILLS, HUDDERSFIELD, ENGLAND.

The Author of an "Introduction to the Study of the Diatomaceæ."

From "Photography Applied to the Microscope."

The illuminant may be either (1) oxy-hydrogen lime-light, (2) coal gas, (3) paraffin, or (4) day light. The oxy-hydrogen light is probably the most convenient for the majority of workers, two forms of jet being available, (1) the "blow-through," (2) the mixing jet. The former is the safest for beginners to work with, the oxygen gas being blown through a hydrogen flame upon the lime cylinder, but the light is not so good as that obtained from the latter, in which the oxygen and hydrogen are mixed in a chamber, previous to consumption at the nozzle. The nozzle of this jet should be fine in bore, rather finer than when for use in the lantern; by this means a nearer approach is obtained to the theoretical "point of light." A very good mixing jet, invented by Mr. Andrew Pringle, is provided with a special cut-off tap which, in one movement, cuts the oxygen off completely, and turns, at the same time, the hydrogen down to a minimum. The limes should be of the hardest description. All good jets are provided with an arrangement for turning the limes when they become pitted, for if their use be continued in this state, the flame is liable to spurt sideways, and so crack the condenser. The gas for the jet can be obtained compressed in steel cylinders.

In our own case we use the oxygen from a cylinder provided

with a regulator which renders the adjustment of the flame possible at the taps of the burner; but take the hydrogen from the mains—or rather, we ought to say, we use coal gas for hydrogen—the only danger in this method of working is that the oxygen must be turned on carefully, as otherwise it may be blown round into the mains, and thus extinguish the light at the jet, and form, into the bargain, a pleasant surprise for the next person who attempts to light the gas in another part of the house; but with care this cannot happen. Using ordinary coal gas alone as an illuminant, we have used an Argand burner with fair success, but found it not so good as a Welsbach flame, which is a Bunsen flame playing upon the interior of a cap made of cotton fibre netted and coated with a mixture of metallic salts, chiefly oxide of zirconium. We have also at a press used a common fish-tail burner screwed into the position of the nozzle of the mixing jet. this device being used when we ran short of oxygen, but it is difficult, by this means, to obtain a good enough light to work with any but very low powers.

An ordinary paraffin microscope lamp is also available, but is better suited for low powers than high.

Day light requires special arrangements scarcely within the reach of ordinary amateurs; a heliostat is needed to keep the sunlight upon the condensers. The heat from this illuminant must be cut off by using ammonio-sulphate of copper cell.

In our our own practice we use a four-inch condenser, out of an optical lantern, to collect the rays from the source of illumination, and so arrange it that it throws a converging pencil of rays, the apex of this cone being in the diaphragm of the microscope. When colored screens are used, they are placed between the light and this four-inch condenser, this position having two advantages which are, (1) small imperfections in the glass are of no consequence, (2) and if the flame should spurt sideways it is better to lose this glass than an expensive condenser. In order to do away with vibration of passing traffic, etc., being transmitted to the instrument, we place it on two rolls of cotton wool, one supporting each end of the microscope board.

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PRIZES TO BE AWARDED FOR ORIGINAL WORK WITH THE MICROSCOPE.

The following sums of money have been placed at the disposal of the American Microscopical Society, to be given

as prizes for the encouragement of microscopical research, and Professors S. H. Gage, D. S. Kellicott and W. H. Seaman, were appointed a committee to prepare the conditions on wnich they should be granted. The competition is open to members of the society, and to those who make application for membership before submitting their papers to the committee.

1 and 2, — Two Prizes of $50 each.
3 and 4, — Two Prizes of $30 each.
5 and 6, — Two Prizes of $25 each.
7 and 8, — Two Prizes of $15 each.

The committee have prescribed the following conditions :—

1. One prize of $50 for the best paper which shall give the results of an original investigation relating to animal life, made with the microscope, and of not less than 3000 words in length. The methods by which the results were obtained to be given in full.

2. One prize of $50 for the best paper which shall give the results of an original investigation made with the microscope, and relating to plant life, of not less than 3,000 words in length. The methods by which the results were obtained to be given in full.

3. 4. Two prizes of $25 each, for the second best papers on animal and plant life, respectively, upon the above conditions.

The papers, drawings, and speciments entered for the above prizes to be submitted to the committee on or before July 1, 1893, and the papers and drawings to be published in the proceedings.

5. One prize of $30 for the best six photomicrographs on some subject in animal or vegetable histology, whose structural features are to be illustrated by the photomicrographs of the following amplification, viz., 50, 150 and 500; two each. These are to be made by transmitted light, printed on albumen paper, from untouched negatives, which, with the specimens from which they are made, are to be submitted with the pictures to the committee.

6. One prize of $30 for the best collection of six mounted slides illustrating some one biological subject. These slides must be accompanied with a full description of the method of preparation of the specimens.

7 and 8. Two prizes of $15 each for the second-best collection of photomicrographs and slides, respectively, on the conditions above stated.

CAMERA LUCIDA AND NEUTRAL TINT REFLECTOR.

BY ALBERT SCHNEIDER, M.D., MINNEAPOLIS, MINN.

From Primary Microscopy and Biology.

Camera Lucida (Latin, camera an arched roof, and lucida bright). The student should always delineate objects under examination. The image is thereby more firmly fixed in his mind; besides, it teaches him to observe more closely. He will be surprised to find that he observes things which he would not have noticed otherwise. The camera lucida and neutral tint reflector are contrivances used with the microscope in drawing images of objects under examination. The student of average ability can construct the neutral tint reflector for himself.

Take an ordinary cover glass, incline it 45° to the eye lens of the ocular, so that the centre of cover glass and centre of eyepiece will coincide; fasten it in its place by some contrivance. Now, incline the tube of the microscope till it is at right angles to the pillar. The cover glass will refract the image at right angles. The eye, looking down through the centre of the cover glass, will see the image projected on a paper placed below on the table. The position of the light and mirror must be changed to produce the proper illumination. Be careful to avoid too much light where you are going to draw. A prime object in drawing is to produce exact representations. Students should use paper ruled into squares. Place a cover glass ruled in squares on the diaphragm of the ocular; this projects the image of the squares with the image of the object. By this means very exact work can be done.

Amplifications and reductions can be made at will. Cut off most of the light from the paper on which the image is projected, so that it will appear in clearer outlines. Get a good, sharp, lead pencil, and trace the outline of the image on the ruled paper. It is well to use a tinted cover glass, as it gives a better defined image. The student will be surprise to find what he can accomplish by this simple means. The camera lucida consists of a prism, and is used in the same manner as the tint reflector.

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TAKING CARE OF A MICROSCOPE.

When through using the microscope, separate the various parts as much as is necessary, and wipe them perfectly clean and dry, with a silk handkerchief or piece of chamois skin.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

FLIES AND THE CHOLERA.—It has been found that flies convey contagion. An investigator has fed them on broth infected with cholera dejecta, and found that the flies emitted foecal matter loaded with active cholera microbes. Also, that for three days after their diet had been changed to sterilized broth, the cholera microbes continued to be ejected. It is not safe to permit flies in kitchens or in dining rooms. Inasmuch as flies are much more abundant in Washington than in Paris, it is probable that the cholera, once here, will make far greater ravages than in Paris.

THE SOCIETY PRIZES.—We desire to call attention to the list of prizes enumerated on a preceding page. Should it be found that this year does not furnish sufficient time for good results, we presume the offer will be renewed for another year.

All photographs and mounted slides for which prizes are given, are to become the property of the society. The object of these prizes is to stimulate and encourage original investigation, by the aid of the microscope, in the biology of North America; and while the competition is open to all, it is especially commended to advanced students in biology, in such of our universities and colleges as furnish opportunity for suitable work. If additional information is desired it may be obtained of the committee on prizes.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

158. *What is "Gage's" method for staining blood corpuscles?—Novice.*

The following is Professor Gage's method: Three or four drops of fresh blood are allowed to fall into 10 c.c. of a ¾ per cent. solution of salt in water, and well stirred to separate the corpuscles; add 100 c.c. of a saturated solution of picric acid in water, constantly stirring; allow the corpuscles to settle, pour off the liquid, add an equal quantity of the salt solution, settle, decant again, and repeat this washing until the salt solution is but faintly tinged with the picric acid; decant at last as completely as possible; add 10 c.c. of a mixture of 5 parts of Frey's carmine and 95 parts of picro-carmine solution, or the picro-carmine solution alone, and stain 1 to 15 hours. Examine a drop occasionally, when sufficiently stained, settle, pour away the staining fluid, and add 10 to 15 c.c. of a mixture of glycerine, 100 c.c., and acetic acid 1 c.c. Preserve and mount in this last fluid.

159. *What is the nature of the pygidium of a flea, referred to in catalogues as a test-object?—P. W. G.*

The pygidium is an oval-shaped organ on the last abdominal segment of the flea; there are about twenty-six disks, each exhibiting a long, central filament, and between the disks are many minute bulbed bristles. These filaments and bristles are the particular test-objects to be observed. They vary in appearance, according to the illumination. The pygidium is supposed to serve the flea as an organ of hearing. It is no longer used as a test, having been supplanted by other objects of more uniform structure and appearance.

160. *Can you give a complete formula for an amateur to try in making Farrant's solution?—S.*

Boil an excess of arsenous acid (white arsenic) in water to make a saturated solution; cool and filter. To 4 ozs. of this solution add 4 ozs. of picked gum arabic, and let it dissolve completely in the cold. Then add 4 ozs. of pure glycerine.

Mix thoroughly; strain through a well-boiled silk cloth (say an old handkerchief) in this manner: Pour 4 or 5 ounces of the thick solution in the centre of the cloth, gather up the corners and sides, and twist them together so as to confine the liquid in the centre. Then twist carefully to make a pressure on the globular fluid mass, and force it through the cloth; allow it to fall, in large drops, into the stock bottle. Some two or three ounces may be secured from the above amount, but this will last a long time. Pharmacists have other and better methods of filtering gelatinous fluids. The above method was used by the writer, and produced a clear, permanent article. Amateurs and others, whose time is worth about 50 cents a day, may try the above formula.

PRACTICAL SUGGESTIONS.

To Cement Wood to Glass.—Gum some labels of paper to the glass. If properly dried, nothing but scraping or soaking will remove them. Then cement the wood to the paper, using —virgin rubber, 2 parts; resin, 1 part; gum shellac, 2 parts. Melt together and apply hot.—*Sci. American.*

To Bore Holes in Glass.—Break off a part of the tip of a three-cornered file, and grind a triangular point upon it. Avoid heating it enough to injure the temper; then make your holes in it just as you would make holes in wood, with an awl, using turpentine to moisten the bearings of the glass. The edges of the file can be sharpened with an oil stone.—*Sci. American.*

Pharmaceutical Study.—At the Trinity University, Toronto, a school of pharmacy has just been established, and in order to receive the degree of Phar. B. the candidate must pass an examination in "botany, including microscopy." For the degree of Phar. D. his advanced botanical work must include either classification or bacteriology.

Radam Microbe Killer.—In an advertisement contained in the *Canadian Pharmaceutical Journal* for May, 1893, Wm. Radman informs the public that "our rates allow the retail trade to make from 45 per cent. upwards on sales," and that "druggists will be surprised at the sales they will make when once they have the microbe killer in stock."

CORRESPONDENCE.

FARRANT'S MEDIUM.

I found Carpenter's recipe in Thomas Davies' "Preparation and Mounting of Microscopic Objects" about thirteen years ago, and a druggist prepared for me about a pint of the solution. I work with it yet, though I am sometimes troubled with air bubbles, but it is not my favorite medium. I find that when it is overcharged with camphor, crystals will form in the mounts. These are very troublesome with polarized light. At that time fluids could not be sent by mail, and, not wishing to pay express charges on the solution, I had it made at home. I do not think that there is ground for complaining about the prices of microscopical appliances. The instruments will last for a lifetime, and an ounce of any solution lasts, also, a long time. Then, the sale of these things must be very slow; if salt and sugar were used as sparingly as microscopical apparatus, I think they would be quite as expensive.—P. W. G.

RECENT PUBLICATIONS.

The Birds of Montreal. By Ernest D. Wintle. Montreal, 1893. Price. $1.00.

This is a special study of the birds frequenting the island of Montreal. The list is believed to be a correct and complete one of all the species of birds occurring in the district. The work describes 251 species and subspecies of birds, with notes on each as to whether they are "permanent residents," or those that are found regularly throughout the year; "winter visitants" or those that occur only during the winter season, passing north in the spring; "transient visitants," or those that occur only during the migrations in spring and autumn; "summer residents," or those that are known to breed, but which depart southward before winter, and "accidental visitors" or stragglers from remote districts; giving their relative abundance, as to whether they are rare, scarce, common or abundant, data of nests and eggs when found, and especially noting the species that breed in the city and Mount Royal Park; also, data of migratory arrivals and departures, and other notes, all of which are deduced from original observations made during the past ten years. Orders may be sent to us.

THE MICROSCOPE.

JULY, 1893.

NUMBER 7. NEW SERIES.

THE GROWTH OF MICROSCOPY AND OPPORTUNITIES OFFERED BY IT TO EARNEST STUDENTS.

BY M. I. CROSS, LONDON, ENGLAND.

(From Introduction to Modern Microscopy, London, 1893.)

The history of the development of the microsope is exceedingly interesting, and itself would fill a small volume: suffice it to say that it was but sixty-eight years ago, or in 1824, that Tully made the first achromatic microscope. Since that time, step by step, such progress has been made in its construction as would be scarcely realizable to those who have not followed it. Ten years ago the President of the American Society of Microscopists, in his annual address, remarked that lenses which were believed to have so nearly reached the limit of perfection fifteen years ago are antiquated now and the theoretical limit of perfection has moved forward like the horizon and is as far off as ever." The same statement applies to-day, and even within the last five years, lenses have been placed at our disposal by the leading opticians giving results that our microscopical predecessors of fifteen or twenty years ago would never have dreamed of; and still further experiments are going forward, with the view of giving greater advantage in microscopical research. What has been done in the lens parts of the microscope has also been effected in the mechanical, and a far better microscope can be purchased to-day for a given sum than a few years ago could be obtained at nearly double the cost, bringing that which was a luxury, and acquirable only by the wealthy, within the reach of the slenderest purse. This is

largely due to the work of enthusiastic amateurs. At leading microscopical societies, notably the Royal Microscopical Society and the Quekett Club, which meet in London, are to be found men whose recreation is in the microscope, and whose suggestions, as the result of personal practical experience and research, are of such weight and value that manufacturers, rivalling one another, have taken advantage of the ideas of these workers. Also in the medical world its advantages have become appreciated, and necessitated the introduction of reliable and high class instruments at a moderate price. Not many years ago a hospital rarely possessed more than one or two microscopes, and these were generally kept under a glass shade, more for ornament than use; but to-day every student has to provide himself with one, and become practically acquainted with the ultimate structure of every organ and tissue both in health and disease. The chemist finds it indispensable, and our medical officers of health employ it for detecting adulterations, entozoa, etc. So that not only is it one of the most intelligent means of recreation, but it is also invaluable in many duties affecting our immediate comfort and welfare.

The demand for microscopes caused by their large employment by professional men and students has caused a corresponding competition among manufacturers to produce the best possible instruments at the lowest price, suitable for the purposes for which they were required, and this has been an important factor in the present state of good quality at low cost.

Some people hesitate in taking up the microscope at all, not caring to use it merely as an amusement, and thinking that they have no special genius for science, or that the ground has been gone over so repeatedly that there are no new worlds to conquer, and that it is perfectly hopeless for then to discover any new organism, or for any novel idea to cross their minds. This is quite a mistake, and it will surprise any microscopist who uses his instrument thoughtfully how love for the work will grow upon him and how gradually he will become master of some special line which he has adopted as his own. On this point we would echo the words of a well-known microscopist. "It needs no marvellous intellect, no special brilliancy, to succeed in a scientific study: work at it ardently and perseveringly, and success will follow."

CHOLERA: ITS PREVENTION AND TREATMENT.

BY ELMER LEE, M. D. CHICAGO, ILL.

A mass meeting of physicians for the consideration of the above subject was recently held at the Great Northern Hotel, under the auspices of the Practitioners' Club of Chicago, and the following paper was read.

The leading propositions suggested and tried in the treatment of Asiatic cholera during the epidemic of 1892 in Europe consisted of the following general plans. Early in the epidemic, lactic acid treatment was proposed on the ground that it would neutralize the alkaline accumulations in the bowels and so stop the multiplication of the bacilli.

An Englishman residing in Paris considered cholera a hyperaemia of the spinal cord. His prescription was ice poultices continuously applied to the region of the whole spinal column. A small pamphlet was published by the doctor in defense of his conclusions and to present testimonials in favor of his congestion-theory. As this system of management was not seriously considered by cholera physicians its efficacy cannot be stated.

The use of large doses of the Russian remedy, salol, the invention of Prof. Nenski, of St. Petersburg, grew in favor as a new remedy during the epidemic. The average result of cases so treated in St. Petersburg, and by my American colleague, Blackstein, in Baku, and in other provinces in Southern Russia, could not be said to be satisfactory. Finally, at the last of the epidemic, its influences had come to be considered less and less valuable—this, however, can be said—it was in all and all more largely used than any other new remedy. Still it would not be safe to place too much trust in it.

Calomel was everywhere a remedy even more used than salol. Formerly this drug was used in very large doses, but last year it was the very small doses which found favor. Especially was this true in the treatment of cholera in Hamburg.

Of the surgical measures, the infusion of solutions of salt were most practiced. The solution consisted of distilled water in which was dissolved one half of one per cent. of common salt. This liquid was warmed to the temperature of the blood and either introduced directly into some large vein or injected

with a long needle and a large barrel syringe beneath the integument of the abdomen. The amount of salt solution used in either case would be from one pint to one quart each time. In one case treated at Hamburg as much as thirteen quarts of salt-water were used from first to last. The patient recovered. The subcutaneous injections were frequently followed by cysts and sometimes abscesses appeared. Intravenous injections sometimes proved a godsend, but more frequently disappointment could be said to be the result. These injections were only used in the third period of the disease or the stage of collapse, algidity or asphyxiation, at which period it would be rather unreasonable to expect recovery by virtue of any treatment.

The Italian treatment, as it was called in Russia, was much used and with frequent gratifying success. This practice was introduced by Prof. Cantani. It consists of a clyster composed of the following constituents:

Boiled water or infusion of chamomile, (warm) 2 litres.
Tannin, 5 to 10 grams.
Laudanum, 30 to 50 drops.
Powdered gum-arabic, 50 grams.

This or some part of the solution is occasionally passed into the rectum, to be retained if possible by the patient. In the experience of those who have followed this method of treatment almost every case taken at the beginning of the disease has lived. It is certainly more reasonable in principle than simple medical management.

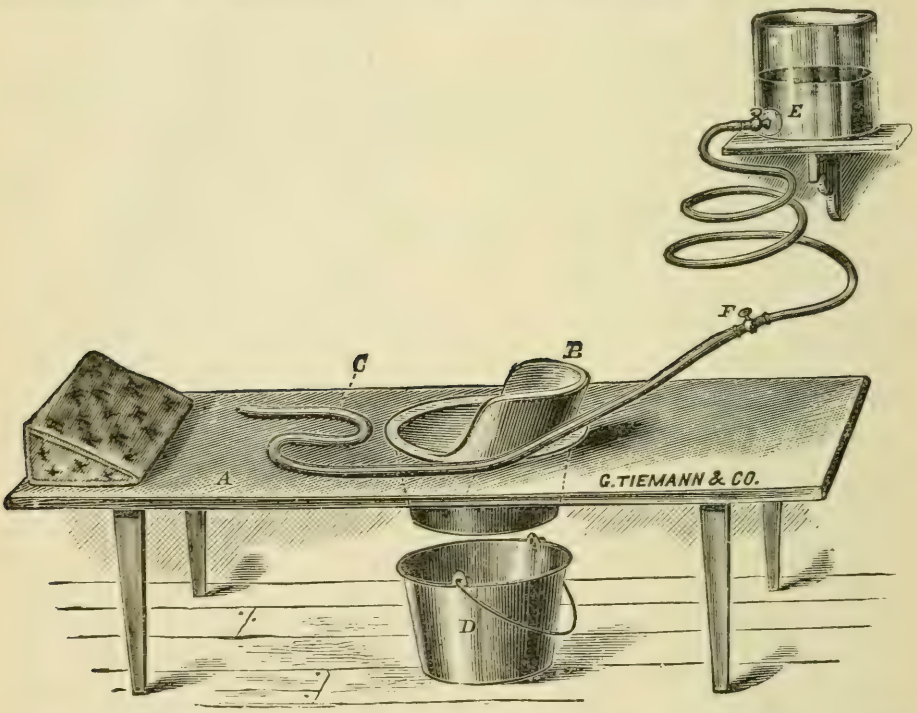
Of the experiments of Ferran, of Spain, and Haffkine of the Pasteur Institute, much has been said, but what has been said has failed to bring conviction to my mind. As cholera itself cannot be said to protect one who has had the disease, and recovered, against a second attack, then that which is less than cholera in influence cannot be expected to do it. The seat of the disease is located in the intestines, and, so long as the infectious juices are there, the lymph vessels in the processes of physiological function will continue to infect the blood. Can we hope to thwart physiological action of absorbents by hypodermic injection of cholera culture, made at some time, it may be years previous to the date of the passing epidemic?

The answer by my judgment, is that such expectations are flimsy. The caprice of Stanhope at the Hamburg Hospital cannot seriously pass for an argument in favor of anti-choleraic vaccination. His interesting but wildly exaggerated stories were the product of a newspaper's love for sensation, and profit of increased sales of newspapers.

My own personal thoughts concerning cholera and the method of treatment, as practiced by me both in Russia and at Hamburg during the epidemic of 1892, will occupy the remaining time allotted me.

It is now well known that cholera is a disease of the alimentary canal. Its inciting cause is believed to be a germ taken into that canal through the medium of food and drink. There its presence is protested against by the absorbent vessels, which eliminate from the food the nutriment for the body. The first symptom produced by foreign invasion in the intestines is a diarrhœa, which may precede vomiting from one to three or even four days. If this be true, the bowels must be the seat of disorder, and the most direct method of reaching them by medication must be the best. If the stomach could be emptied of the foul material before the poison has passed further, there might be speedy relief and, indeed, no real cholera. After it has passed into the intestines, medicine administered through the stomach may be slow in reaching the seat of the disease, and even then can only mingle with the poison, holding out the hope that the one will be neutralized by the other. This hope, in truth, is seldom realized. But if the poison can be removed from below, the course is left clear for nature to recuperate itself. The diarrhœa is an evidence of the great exertion put forth by the organism to rid itself of the death-dealing agency, and probably it would be effectual in the great majority of cases were it not that the nervous forces of the system are exhausted by the terrible strain before the required evacuation of the bowels is completed. A large irrigation of hot water, made soapy preferably by neutral liquid soap, introduced into the colon through a suitable rubber tube, is the simplest, and I am prepared to say further that it is a more satisfactory way of treating cholera than any other with which I am acquainted. The time to begin the irrigation is at the very earliest possible moment Save the blood every single moment of infection by im-

mediate action, even if there is the faintest suspicion of cholera either with or without diarrhœa. In every post-mortem seen by me of cases of death in which there had been no marked diarrhœa, the colon and small intestines were filled with accumulations of choleraic matter which swarmed with comma bacilli. The rule from which there need never be deviation is to treat the patient by irrigation of the bowels and rinsing of the stomach, without waiting for confirmation of the diagnosis either with the microscope or by the culture test. The best part of the practice is always to save the patient, even at the expense of fine statistics. The accompanying illustration ex-



plains the manner of using irrigation of the intestines. Such apparatus is suitable for places of public treatment of the sick. In private practice the syringe would take the place of the irrigating apparatus. The exact model of the irrigating table used by me in St. Petersburg may be seen at Mr. Sargent's store on Wabash avenue.

For internal treatment my experience taught me that the medicinal peroxide of hydrogen, of Marchand, given in cupful doses of the strength of 4 per cent., or even much stronger, was a better antiseptic than any other drug heretofore known in

the treatment of cholera. Then the treatment would be, first, immediate irrigations with hot water and soap using from one to three gallons at a time twice a day for the first and second days. Once a day afterwards if required, which is seldom the case. At the same time cleanse the stomach with medicinal peroxide of hydrogen and hot water used freely—by urging the patient to drink. The feeding and nursing are the same as would be required by a patient suffering from septicaemia or other prostrating disease. My belief is based upon personal experiences and the following surgical measures and medical treatment, viz: Irrigation of the bowels, always first with hot water made soapy with neutral liquid soap or a good castille soap; second, cleansing and rinsing the stomach with hot water and medicinal peroxide of hydrogen, of Marchand, continuing till it is well washed; third, food and nursing; fourth, medicinal peroxide of hydrogen of 4 per cent. strength given in cupful doses at intervals of two hours during the sickness till convalescence; fifth, meet the requirements as they come up, as would be done in any other grave disease, using whatever personal experience has taught us to believe is good. Cleanse the bowels, wash the stomach, feed the sick, keep them warm if cold, and reduce excessive heat by the cold bath rather than reliance upon drugs; using anything in an emergency that is the easiest and most accessible to procure. The cholera patient may be convalescent inside of the first few days, or if not convalescent and not dead, the case goes into the typhoid state, after which convalescenec may be deferred for several weeks or death may be the conclusion. The temperature prior to the fifth day is generally subnormal or a little above, but on the fifth day marked exacerbation and elevation of temperature indicates the typhoid condition.

INSTRUMENTS DESCRIBED—IV.

BY QUEEN & CO., PHILADELPHIA.

The Acme No. 5 Microscope.

This is an instrument of thorough construction, with adjustments smooth and perfect in action, the lenses being of especial excellence and clearness of definition.

We can reccommend this microscope to pharmacists as an efficient instrument for their requirements; also for general school use, in showing the tissues of plants, circulation of blood and multitudes of other interesting objects.

Simplicity, *strength*, and *solidity*, with low cost of construction are especially claimed for this microscope. The base is a heavy tripod, so proportioned that the microscope is very firm when vertical or inclined. The collar, in which the body tube slides, is firmly dovetailed with and screwed fast to the arm.

The mirror (concave) is of ample size and swings laterally for oblique light, or over the stage for illumination of opaque objects. A revolving diaphragm to regulate the illumination is attached beneath the stage.

By means of the draw-tube, the full English tube-length of ten inches may be obtained when desired.

The plan of constructing the fine adjustment has the following features especially fitting it for classwork in the laboratory

First (and principally). Perfection of action: the upper plate carrying the object, must respond instantly to the movement of the screw, upward by positive action, downward by the spring of the plate; and without any lateral or side motion; these, of course, are the essential features of a fine adjustment.

Second (and important). This perfect action will continue as at first; as there are no joints to wear loose or become strained, there can be developed no lost motion nor lateral motion, by wear or rough handling, all excepting the screw being made practically one piece. *Third.* It is inexpensive in construction.

(An objection is sometimes made that one side of the stage-plate is moved, while the other is not, thus elevating one side more than the other. We only ask those to whom this may appear an objection to make a practical and careful test. They will find that this objection is utterly invalid in practice, as the range of motion required is very slight; at mid-range the stage-plate is strictly horizontal.)

We can well recommend this microscope to medical students, and to physicians who may not desire to purchase a more expensive intruments, as *efficient for histological work and urinary analysis.* It has society-screw, and is furnished with1-inch and 1-5 inch objectives, and one Huyghenian eye-piece, in upright case with handle. Powers range from 40 to 350 diameters; the 1-5 inch is a lens of such good definition (and sufficient aperture) that it will resolve *P. angulatum.* Price, complete, in neat imitation mahogany case, $28.00.

Clips and Ledge.—Nearly all microscopes are provided with a pair of spring clips to hold the slide. Convenient as these generally are, they often prove a positive nuisance, especially when examining temporary mounts, by "whisking" off the cover glass at the most inopportune moment. A mere ledge, to rest the slide against, is more convenient. This can be improvised by bending a strip of thick sheet lead so as to grip the stage sufficiently firmly to prevent the sliding down of the slide when the stage is inclined, and still capable of being easily pushed up and down. (This applies only to the rectangular stages; not to the round ones).—H. M. Wilder, *in Druggist's Circular.*

A CHEAP ROCK-CUTTING MACHINE.

BY W. N. SHERMAN, M. D., MERCED, CAL.

On page 86 (June number) appears an article on a new machine for grinding and cutting mineral sections, stating that the price of the machine is $130. A description of a home-made cheap apparatus, for the same purpose may be of interest. While not so elaborate or complete, it answers an excellent purpose. Storage cells are used. These consist of four cells with five plates each, three positive and two negative. The plates are made of sheet lead one-fourth inch thick, 7 by 8 inches with perforations, one-fourth inch apart. These round holes are to be filled with the active material, composed of the red oxide of lead for the positive and the yellow oxide for the negative. The holes are threaded inside so as to firmly retain the forming paste during charge and discharge. The plates are connected together and placed in wooden cells which are lined with an acid-proof paint, and have a neat cover or lid over box, which contains all four cells. The cells are about 150 amperes each, and are connected in series so that two, three, or four cells may be used according to the power required. These cells are charged by gravity cells and are receiving a continuous current when not in use. They are connected to a low resistance motor costing $15. It is one-eighth horse power or eight volts, and runs at a rate of about 3,000 per minute. It may rest upon a table or under a table, and is connected by a round leather belt to a small jewelers' lathe, which is arranged for various wheels, for sawing, grinding or polishing. The drip cups and pans, are easily improvised by the user. These same cells can be used for various other purposes, and the motor likewise. I use them for microscope lamps, dark rooms, for surgical lamps, galvano-cautery, surgical engine, etc. The cost of maintenance does not equal that of the Electric Light Co. charges, and when not in constant use they are always fully charged. The whole apparatus may be set up at a cost not to exceed $75, and much cheaper, if cells and motor are all home-made. The motor is portable, and can be used for ventilating fan, static machine, and various other purposes. The speed is controlled by a home-made foot rheostat, inserted in the battery circuit. *Two* storage cells of above size furnish sufficient power for all my work, in grinding and polishing.

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CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

THE LIBBY PRISON WAR MUSEUM.—Of the many attractions outside of the World's Fair in Chicago, there are but few in which there is so much interest centered as there is in the Libby Prison War Museum. In 1889 this celebrated prison was removed from Richmond to Chicago and converted into a War Museum. The project was undertaken by a syndicate of the best-known business men of the city whose enterprise was conceived in a commercial spirit, but has attained a national reputation. A project such as this was never before heard of. To move a brick and stone building the size of Libby more than a thousand miles, across rivers and mountains, was an enterprise that many of the best known contractors in the West refused to undertake at any price. But the move was made with success. Then the famous old structure was filled with war material that represents the work of a lifetime and the expenditure of half a million dollars. The great collection is conceded to be second to none in the country and includes much of the most valuable material that the greatest civil war the world has ever known has left to posterity. The collection includes thousands and thousands of relics of every description, many of which form important links in the history of the Nation. The old building itself is fraught with interesting memories and

the story of the celebrated tunnel escape of February 9, 1864, never fails to interest the visitors. One hundred and nine Union officers made their escape through that tunnel, which formed one of the most thrilling events in the history of the war.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

161. *Give in detail the best way to imbed pathological and biological material in celloidine, so one can follow each stage. How may I overcome the "giving" of the material so as to get thin and uniform sections?—E. F. H.*

Minot's method contains all the essentials. Make two solutions of celloidine in a mixture of equal parts of absolute alcohol and ether. A thin syrupy solution for infiltrating the tissue, and a thick molasses-like solution for the proper imbedding medium. The tissue, properly hardened and dehydrated in alcohol, is placed in a mixture of equal parts of absolute alcohol and ether for 24 hours, then directly into the thinner celloidine solution for one to three days, according to the size and firmness of the specimen. Cut a flat top cork to a size to accommodate the specimen, wrap a piece of filter paper around it and fasten together with pins, the whole forming a sort of a box with a cork bottom. Wet the cork bottom with absolute alcohol, drop in some of the thick celloidine. When somewhat hardened, arrange the specimen in place. When firm enough to stand, fill the box with the thick celloidine so that it will cover the specimen about half an inch deep. The solution shrinks considerably in hardening. Allow the box and contents to stand until firm enough to hold together. A piece of lead with a pin through it may be stuck to the lower side of the cork so the whole will sink right side up, then drop it into 70 or 80 per cent alcohol. After one to three days the celloidine will be hard enough for cutting. Strip off the paper and

trim the mass if necessary. Strong alcohol will soften celloidine and dilute alcohol will allow it to harden. The specimen may remain in the dilute alcohol until firm enough for cutting. A sliding cut, using the whole edge of the knife, must be employed and the blade kept flooded with 50 per cent alcohol.

Celloidine cannot be cut into very thin sections, but is useful for tissues that would be injured by the heat employed in paraffine imbedding. See Am. Mo. Mic. Journal; Vol. VII, p. 229, for Minot's method in full.

162. *How shall I treat sections after staining in logwood, borax carmine and the anilines?—E. F. H.*

Logwood staining. After staining, simply wash in water containing a trace of soda (alkaline,) dehydrate in alcohol, clear with oil of cloves, drop on balsam and cover.

Borax carmine. (Must not touch water). Wash in acid alcohol, (alcohol 5, hydrochloric acid 1,) then absolute alcohol, clove oil, balsam.

Safranin. Wash in alcohol, clear in turpentine, balsam, iodine green (methyl green,) wash in water, alcohol, xylol, xylol balsam.

Methyl blue. Wash in water 100 and acetic acid 1, then absolute alcohol, cedar oil, balsam.

Carbol-fuchsin. Wash in 25 per cent solution of sulphuric acid in water, about half a minute, then in 60 per cent alcohol, then absolute alcohol, cedar oil, balsam.

Oil of origanum may be substituted for cedar oil, for clearing aniline stained sections.

163. *How is the Ehrlich-Biondi triple-stain made? How is it used for staining blood and tissues?—Leslie Whalley.*

Methyl green (Iodine green,)	½	grain	in	100	drops	of water.
Acid fuchsin,	½	"	"	40	"	" "
Aniline orange, (Safranin,)	2	"	"	200	"	" "

Mix these solutions and filter. Spread the blood on a slide, dry over a flame, stain in the above solution 10 to 15 minutes, wash carefully in water, dry, and apply xylol balsam.

For tissues, stain the section in the above solution for 12 hours, wash in water, dehydrate in absolute alcohol, clear with xylol or oil origanum, drop on xylol balsam and cover.

PRACTICAL SUGGESTIONS.

Rapid Polarization—Since writing my last article on this subject (*Druggist's Circular*, June,) I have simplified the procedure still more, so as to make it more convenient. My modification can be applied to any microscope provided with a diaphragm wheel. Solder to the largest hole of the diaphragm a short tube, say three-quarters of an inch long, and fit into this tube a nicol, turning the latter so that the long diameter runs from front to back, when it is brought under the hole in the stage; the nicol is then in the best position. (An inspection of a mounted nicol, polarizer or analyzer, will show that the nicol is held in place by pieces of cork.) In polarizing, I merely revolve the diaphragm so that the nicol comes under the hole in the stage, and then clap on the tourmaline (or other nicol) over the eye-piece. There is then no need to be careful to face the light, nor to observe any particular slope of the microscope tube, and, what is better still, the illumination is a good deal brighter than with a black glass. If there is no diaphragm wheel, recourse must be had to the black glass, the illumination of which may be greatly improved, however, by super-imposing a plate of ordinary glass. The optical reasons for this improvement are somewhat obscure, a thick piece of plate glass, blackened on the reverse side, does not brighten the illumination as much as a piece of ordinary glass on top of a thin, blackened glass. Still easier, place a piece of glass (a slide, for instance) on top of a *piece* of *black "japanned"* tin.—*H. M. Wilder.*

CORRESPONDENCE.

THE TARIFF ON BOOKS.

In general I am opposed to any tariff except for revenue. I think I have good grounds for that position, but a discussion of them would lead too far at this time. On some articles I am opposed to any tariff whatever. Among the latter are scien tific books and educational works in general.

My reasons for so thinking are briefly stated as follows:

First; real scientific work is carried on by people who, financially speaking, belong to the middle classes. As far as my observation goes, scientific people seldom amass wealth, and many eak out only a precarious existence. Scientific pursuits and accumulation of wealth seem diametrically opposed. In view of this fact, to curtail the acquirement by this class of people of books and instruments, the forces by which they work, by increasing the cost, is to my way of thinking a little irrational.

Second; I think it is wrong to tax one class of people for the benefit of another, as in case of the protective tariff, or for the government, that is the people, to benefit in the way of a tax on the class from which it receives so many benefits directly and indirectly.

Third; I think that under the conditions of free trade, under which conditions there can be no more than healthy competition, the interests of not only the manufacturer but the consumer will be served in the very highest manner.

Within the limits of a short letter, it is impossible to offer any argument for the support of one's statements, but the above represents fairly well my position with respect to the tariff on books and microscopical instruments. I am glad you have given the microscopical people an opportunity to express themselves in this matter, and I await the publication of the results with a great deal of interest. I was very much interested in the results of the other request that you sent out as to the position of your subscribers with respect to the tariff.

C. E. Stoner, Des Moines, Iowa.

RECENT PUBLICATIONS.

First Book of Nature. By James E. Talmage. Salt Lake City, Utah. 16 mo, 306 pp. 80 cuts.

The first principles of zoology, botany, mineralogy and astronomy are here briefly outlined for use in the District Schools of Utah. Classification and technical definitions have been wisely omitted. "The writer has sought in a sincere though humble way to demonstrate that Nature is but another name

for the will of God as expressed in His works." We are sorry that he has felt called upon to do this, for it leads him into some absurdity. Speaking of the vast variety of living forms, which he says, "the Creator has placed upon the earth, each with a special purpose to meet," he remarks that "everyone is contented to live and to move within the sphere for which its Maker intended it." Elsewhere, he says: "Sharks readily attack men who may be swimming or diving in the water and are able to bite off a human leg at a single snap. Though these savage monsters are doubtless intended to be butchers and destroyers, the Creator has wisely checked their facilities for unrestricted slaughter." So, biting off a human leg occasionally is within the sphere which the Creator intended sharks to occupy! The author knows that many fishes feed upon their own young and yet he says their Maker intended such unnatural doings. Certain other forms like the seals kill their prey but eat only a small fraction of what they kill. Villainous snakes eat immense numbers of our food fishes. Certain birds destroy the eggs of others out of pure malice. If all this is being "content to live and move within the sphere for which its Maker intended it," the children will need some explanation of His intentions which is not at hand, or else they will be led to disrespect His character.

THE MICROSCOPE.

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We can furnish new subscribers with complete sets of the New Series but of the old series, there now remain only sets for 1887,'88,'99,'90,'91 *and* '92. *A few more odd Nos. will go off at the rate of* 25 *for a dollar.*

THE MICROSCOPE.

AUGUST, 1893.

NUMBER 8. NEW SERIES.

EXTRACT FROM THE PRESIDENT'S ADDRESS BEFORE THE MANCHESTER MICROSCOPICAL SOCIETY.

By J. F. GOODE,

MANCHESTER, ENGLAND.

It is very essential that those who intend making microscopical study their specialty should take means to render themselves as conversant as possible with everything that appertains to the management of the microscope. I think all will agree with me that to be able to use the instrument to full effect and gain a correct estimate of the object under examination, it is essential to know something of the laws of optic which are concerned in the production of a true microscopic image. The utilization to the full extent of the powers of the microscope can therefore, only be acquired by long and patient study of those principles on which its correct performance depends, and also on the skillful and effective manner in which the objects examined by it are prepared and mounted. It has been the aim of the sub-section to impart this knowledge and several members who are experts have been good enough to give practical demonstrations on the Friday evenings.

I should like here to refer to the new apochromatic objectives of Zeiss. These lenses have been in use some little time, but as far as I am aware, have not been exhibited nor described at any of our meetings. A special kind of glass, which possesses a wider range in refraction and dispersion than the old crown and flint glass, is used in the construction of these objectives, together with the introduction of special fluorite lenses

into the combination. By this means it is possible to entirely remove the secondary spectrum, leaving only a residuum of a tertiary character, which is got rid of by specially constructed eye-pieces, called compensating eye-pieces, the result being that images perfectly free from colour are obtained. One of the many advantages which these lenses possess is that the power can be increased by specially constructed eye-pieces to a much greater extent than is possible with the old lenses. By this means one objective can be made to do the duty of several; and the microscopist of the future will only require about three objectives to do everything he wants.

Through the courtesy of Dr. Anthony, I had an opportunity of testing the performance of two of these objectives, and comparing them with lenses of ordinary make but of very fine quality, and the result was very much in favor of the new form. Compensating eye-pieces were used with all the objectives tested as they give better results, even with objectives of the ordinary construction, than the Huyghenian form generally used. The apochromatics were tested on a variety of objects with the deepest eye-pieces, and there was not the slightest indication of their breaking down. To get a better idea of the superiority of these lenses, the objects were first of all viewed with some objectives of the old construction, but of very fine quality. These were tried with the highest eye pieces they would bear, and were very satisfactory, one very fine quarter-inch running the apochromatic of about the same power pretty close; but there was no mistaking the superiority of the latter under the deepest eye-pieces, all the minutest details coming out perfectly sharp and clear to the last. Of course, the illumination was of the best, a prism being used instead of the plain mirror, and the first-class condenser was most carefully adjusted before commencing the trial, the performance of an objective being very much improved in proportion as these details are attended to. The objectives referred to were dry lenses, and in power equivalent to an English inch and quarter-inch. Another advantage of these lenses is the large working distance, and the facility with which the magnifying power can be increased without disturbing the object under examination.

Owing to their more perfect corrections, these lenses are specially adapted for photomicrography, which is becoming more

and more indispensable as a means of scientific research. The chemically prepared film of the photographic plate is capable of recording faint markings and minute structural details, which cannot be detected in the microscopic image by the human eye, or at least very imperfectly. As an illustration of this, from an astronomical point of view, the following facts with respect to the discovery of small planetary bodies which move in orbits between those of Mars and Jupiter may be interesting:— "From observations of the first of these, Ceres, in 1801 until the end of 1891, 321 had been discovered by the comparatively laborious method of eye observation. From that time photography has been pressed into the service, and no fewer than 44 have been found within the last fifteen months. Professor Charlois, of Nice, reports the finding of six during the last week, a feat which would have been considered unparalleled at the beginning of the century." This I think conclusively proves the superiority of photography in special work of this kind. The above is only one of the many applications of photography for recording astronomical phenomena, all of which have been of great service.

It is equally applicable to microscopical investigations; and a much more correct idea of the structure or the nature of the markings in various minute organisms, has been gained by its use, than could have been arrived at by eye observation alone, notably the spendid photo-micrographs of some of the Diatomaceæ, which have been taken with the most perfect and most powerful objectives made. It is impossible to predict to what extent the aid of photography will be found useful in deciding obscure physiological questions.

Professor Exmer, of Vienna, has succeeded in taking the photomicrograph of the image which is formed at the back of the compound eye of an insect. This image he found to be precisely the same as that which would be presented at the back of the single eye of one of the higher vertebrates. As the physiology of the arthropod eye has been the subject of much discussion and diversity of opinion, this discovery may be the means of throwing a new light on the question, and, if so, it will be another of the triumphs of photography in elucidating this and similar phenomena.

DEMONSTRATING CYCLOSIS.

By R. N. REYNOLDS, M. D.,
DETROIT, MICH.

But few objects are so interesting under the instrument as the wonderful Cyclosis in *Vallisneria*. One can see the trains of green balls chasing each other around the cells, by the hour. In this cold climate, I have been unable until this year, to keep the grass through the winter. Pieces of grass with or without roots will live for some weeks in a jar of water in summer, or in a comfortably warm house in winter. After ice began to form along the edge of Detroit River last fall, I gathered some rootless pieces of *Vallisneria* also one root of the same with two blades of the grass attached. I placed the lot in a jar of water which I kept in a cold cellar changing the water once in five to ten days.

Whenever I wished to use a specimen, I broke off two bits about ⅜ or ½ inch long each from a blade of the grass. These I laid side by side in a few drops of water on a *warm* slip of glass, laid a cover-glass on and examined with 1-5 or higher objective. Usually the circulation can be seen at once; at other times it needs to have the light on it for ten or fifteen minutes in order to start it, two bits of the grass are used because one might tilt the cover-glass.

The grass on the roots died before the rootless specimens. The latter remained green and alive until February. I entertained some friends with a specimen of it on the 19th of February. If it had been kept in a warmer location, all would have been dead six or seven weeks earlier. About the end of February I noticed in the case of the specimen with roots that the fine roots and the blades of grass had rotted off the stem, leaving a green stem, of about an inch in length. This I placed in another jar of water and took it up stairs into the living rooms, where it soon sent out new shoots and from it I soon had new grass to use. Had I taken this into the warm room a few weeks earlier, as I shall do next winter, I would have had new grass before the old died. What I learned in this case is that the grass will live much longer when kept at or near freezing point than if it is kept warm; and that the stems between the fine roots and the blades of grass need to be kept in water in a warm place.

THE PRIMARY FOOD SUPPLY IS MICROSCOPIC.

By. PROF. W. K. BROOKS,

BALTIMORE, MD.

[From a memoir on the Genus Salpa.]

As the result of our review, we find that the organisms which are visible without a microscope in the water of the ocean and on the sea bottom are almost universally engaged in devouring each other, and many of them, like the blue-fish and the albacore are never satisfied with slaughter, but kill from mere sport.

Insatiable rapacity must end in extermination unless there is some unfailing supply, and as we find no visible supply in the water of the ocean, we must seek it with a microscope. By its aid we find a wonderfully rich and diversified fauna made up of innumerable larvæ of all sorts of marine animals together with a few minute and simple metazoa, but these things cannot form the food supply of the ocean. It is clear that a single carnivorous animal could not exist very long by devouring its own children, and the result must be the same however great the number of individuals or species.

The total amount of these organisms is inconsiderable, however, when compared with the abundance of a few forms of protozoa and protophytes, and both observation and deduction force us to recognize that the most important element in the total amount of marine life consists of some half a dozen types of protozoa and unicellular plants, of globigerinæ and radiolarians, and of trichodesmium, pyrocystis, protococcus, and the coccospheres, rhabdospheres and diatomes.

Modern microscopic research has shown that these simple plants; and the globigerinæ and radiolarians which feed upon them, are so abundant and prolific that they meet all the demands made upon them, and supply the food for all the animals of the ocean. This is the fundamental conception of marine biology. The basis of all the life in the modern ocean is to be sought in the micro-organisms of the surface.

This is not all, the simplicity and abundance of the microscopic forms and their importance in the economy of nature show that the organic world has gradually shaped itself around and has been controlled by them.

They are not only the fundamental food supply, but the prime-

val supply, which has determined the whole course of the evolution of marine life.

The pelagic plant life of the ocean has retained its primitive simplicity on account of the very favorable character of its environment, and the higher rank of the littoral vegetation and that of the land is the result of hardship.

On the land the mineral elements of plant food are slowly supplied as the rains dissolve them; limited space brings crowding and competition for this scanty supply; growth is arrested for a great part of each year by drought or cold; the diversity of the earth's surface demands diversity of structure and habit, and the great size and complicated structure of terrestrial plants are adaptations to these conditions of hardship.

The conditions of the surface of the ocean; the abundance and uniform distribution of mineral food in solution; the area which is available for plants; the volume of sunlight and the uniformity of the temperature are all favorable to the growth of plants, and as each plant is bathed on all sides by a nutritive fluid, it is advantageous for the new plant cells which are formed by cell multiplication to separate from each other as soon as possible in order to expose the whole of their surface to the water. Cell aggregation, the first step towards higher evolution, is therefore disadvantageous to the pelagic plants and as the environment is so homgeoneous at the surface of the ocean that there is little opportunity for an aggregation of cells to gain a compensating advantage by seizing upon a more favorable habitat, the pelagic plants have retained their primitive simplicity.

The list of pelagic micro-organisms is a long one, but a few forms are so predominant that the others have little significance at the present day in comparison, and we may regard the great primary food supply as made up of two simple protozoa, globigerinæ and the radiolarians, and about five unicellular plants.

Of these only two, the radiolarians and the diatoms, show any great diversity of species, and while the radiolarians are so diversified that the Challenger collection alone furnished more than four thousand species, this variety does not obscure the primitive simplicity of the type, and the most distinctive peculiarity of the microscopic food supply of the ocean is the very small number of the forms which go to make up the enormous mass of individuals.

LIST OF MICROSCOPICAL SOCIETIES.

By CHAS. W. SMILEY,

WASHINGTON, D. C.

[Revised to August 1, 1893. Further corrections are solicited.]

United States.

WASHINGTON, D. C.—American Society of Microscopists (migratory), W. H. Seaman, Secretary.

TROY, N. Y. —Postal Microscopical Club, Dr. S. G. Shanks, Secretary.

California.

SAN FRANCISCO, CAL.—San Francisco Microscopical Society, Geo. Otis Mitchell, Corresponding Secretary.

Colorado.

DENVER, COLO.—Denver Microscopical Club.

Connecticut.

NEW BRITAIN, CONN.—New Britain Scientific Association, M. S. Wiard, Secretary.

NEW HAVEN, CONN.—New Haven Microscopical Club.

District of Columbia.

WASHINGTON, D. C.—Washington Microscopical Society, L. M. Mooers, Secretary.

Illinois.

CHICAGO, ILL.—Illinois State Microscopical Society—A section of the Chicago Academy of Sciences. Wm. Haskins, Secretary, 81 Clark street.

DIXON, ILL.—Dixon Biological Society, Ira W. Lewis, Secretary.

PEORIA, ILL.—Peoria Scientific Association.

Iowa.

COUNCIL BLUFFS, IOWA.—Council Bluffs Microscopial Society.

Kansas.

ATCHISON, KANS.—Sphinx Society, Prof. E. B. Knerr, Secretary.

LEAVENWORTH, KANS.—Leavenworth Microscopical Society, W. D. Bidwell, Secretary.

Kentucky.

LOUISVILLE, KY.—Louisville Microscopial Club.

Maine.

AUBURN, ME.—Androscoggin Microscopial Society, C. E. Williams, M. D., Secretary.

PORTLAND, ME.—Natural History Society, C. B. Fuller, Curator.

Massachusetts.

BOSTON, MASS.—Microscopial Section of the Boston Society of Natural History.

TAUNTON, MASS.—Taunton Microscopial Society, Dr. F. A. Hubbard-Secretary.

WORCESTER, MASS.—Natural History Society.

Michigan.

YPSILANTI, MICH.—Michigan Teachers' Society of Microscopists.

Minnesota.

ST. PAUL, MINN.—Northwestern Microscopial Society.

Missouri.

ST. LOUIS, MO.—St. Louis Club of Microscopists, S. E. Barber, Secretary.

Nebraska.

LINCOLN, NEBR.—Lincoln Microscopical Club, Roscoe Pound, Secretary.

OMAHA, NEBR.—Omaha Microscopical Society, Dr. Wilkeson, Secretary.

New Jersey.

EAST ORANGE, N. J.—Essex County Microscopical Society.

NEW BRUMSWICK, N. J.—New Jersey State Microscopical Society, F. C. Vandyke, Secretary.

TRENTON, N. J.—Natural History Society.

New York.

BROOKLYN, N. Y.—Department of Microscopy, Brooklyn Institute, 200 Washington street, F. H. Hooper, Secretary.

BUFFALO, N. Y.—Microscopical Club of the Buffalo Society of Natural History, S. Hobart Dorr, Secretary.

BUFFALO, N. Y.—Naturalist's Field Club, M. A. Fleming, Secretary.

BUFFALO, N. Y.—Buffalo Microscopical Club, James W. Ward, Secretary.

CANANDAIGUA, N. Y.—Canandaigua Microscopical Society.

ELMIRA, N. Y.—UpDeGraff Microscopial Section, Academy of Sciences.

FREDONIA, N. Y. Fredonia Microscopical and Nautral Science Club, Nelson G. Richmond, M. D., Secretary.

JAMESTOWN, N. Y.—Jamestown Microscopical Society, S. W. Baker, Secretary.

FLATBUSH, N. Y.—New York Microscopical Society, 64 Madison avenue, J. L. Zabriskie, Secretary.

NEW YORK.—American Microscopical Society.

NYACK, N. Y.—Nyack Society of Microscopists, Miss Edith Stillwell, Secretary.

ROCHESTER, N. Y.—Academy of Sciences, (in the Botanical Section there are frequently microscopical exhibits), Frank C. Baker, Secretary.

TROY, N. Y.—Troy Scientific Association.

SYRACUSE, N. Y.—Microscopical Club of Central New York, W. H. Olmstead, Secretary.

Ohio.

CLEEVLAND, OHIO.—Cleveland Microscopical Society, R. Dayton. Secretary.

CINCINNATI, OHIO.—Microscopical Section, Natural History Society.

COLUMBUS, OHIO.—Tyndall Association, C. C. Howard, M. D., Secretary.

COLUMBUS, OHIO.—Ohio State Microscopical Society.

OUTLINE MAP OF THE UNITED STATES SHOWING LOCATION OF THE MICROSCOPICAL SOCIETIES.

Pennsylvania.

PHILADELPHIA, PA.—Biological and Microscopical Section, Academy of Natural Sciences, H. Wingate, Secretary.

ERIE, PA.—Erie Microscopical Society, Rev. Geo. Goetz, Secretary.

WEST CHESTER, PA.—Microscopical Section of the Philosophical Society, F. McClurg, Secretary.

EASTON, PA.—Lehigh Valley Microscopical Society, Edgar M. Green, M. D., Secretary.

PITTSBURG, PA.—Iron City Microscopical Society, Geo. H. Clapp, Secretary.

Rhode Island.

PROVIDENCE, R. I.—Providence Franklin Society, H. S. Hathaway, Secretary.

Tennessee.

MEMPHIS, TENN.—Memphis Microscopical Society.

Texas.

AUSTIN, TEXAS.—Austin Microscopical Society, Dr. T. J. Bennett, Secretary.

Virginia.

RICHMOND, VA.—Richmond Microscopical Society.

Canada.

LONDON, ONT.—Microscopical Section, Entomological Society of Ontario, J. Alston Moffatt, Secretary.

MONTREAL, CANADA.—Montreal Microscopical Society, L. J. Skelton, Secretary.

VICTORIA, B. C.—Victoria Natural History Society, Dr. Newcombe, Pres't.

To Open A Rusty Knife.—We are indebted to *The Inventive Age*, for the following article and for the use of the cuts with which to illustrate it.

Take a piece of soft but strong cord, wind it tightly from ten to fifteen times around the closed blades of the knife and of the knife body itself as shown in Fig. 1. Hold or tie the remaining end of the cord to your middle finger. Find a grassy

Fig. 1.

Fig. 2.

spot or soft place and throw the knife down with all your might, just as you do in spinning a top and as shown in Fig. 2. The centrifugal force, caused by the unwinding of the cord and the rapid rotation of the knife will make the blades fly open like the balls on a governor of a steam engine.

If any readers wish specimens of *Vallisneria* in order to identify it, Dr. Reynolds will be glad to send some free of charge.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Meetings of the American Society of Microscopists.—These meetings have been held of late in close connection with the A. A. A. S. Meetings to accommodate such people as belong to the latter. The result has not been very flattering. We have heretofore explained that the interval between the two was perhaps too great and should be lessened. But now the change has been made for 1893. If it should not succeed as desired, we have an entirely new proposition to make and when the time and place are fixed for 1894, it might be tried. But first a few statistics: The society has 378 members of which 170 are physicians. Few, if any, practicing physicians go to the A. A. A. S. At the 1891 meeting of the Microscopical Society, 41 members were present, of whom 9 were residents of this city. Eighteen physicians and 23 others were present,—a mere corporals guard out of so many members, but 8 of the doctors resided here, and 10 doctors came from outside of Washington.

No profession or occupation has such a use for the microscope as the medical profession. In all local societies, the physicians constitute 40 to 60 per cent of the membership. Perhaps the American Society of Microscopists should tie to the medical conventions rather than to the A. A. A. S. It could easily sit in connection with the biggest medical convention in the United States. The Secretary could probably secure 30 or 40 papers from medical men on medical microscopy and in this way draw

hundreds of doctors into our ranks as active workers. The results would benefit not only the society but also the practitioners.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

164. *How is Hoyer's picro-carmine made, and how used?—L. W.*

Take powdered carmine 2 grains, water 1 ounce, aquæ-ammoniæ enough to dissolve the carmine while heated in a capsule, boil gently until the ammonia has evaporated, cool and filter. Make a saturated solution of picric acid in water, take 4 ounces of it and mix with the above carmine solution, filter, add a crystal of thymol, or about 1 per cent of chloral hydrate, to prevent change.

Stain sections 3 to 10 minutes. Overstaining may be extracted with 70 per cent alcohol, then use absolute alcohol, oil of cloves, balsam.

165. *Can you give the addresses of dealers in the aniline dyes used for staining?—L. W.*

Any of the dealers in microscopical supplies can furnish the aniline stains. Consult our advertising column and send for catalogues.

166. *Explain simply and clearly, how to obtain the numerical aperture of an objective.—B. E. R.*

The proper method is to use the Abbe apertometer, an instrument made for measuring N. A., and indispensable for the measurement of high angled objectives. The following method can be used to measure the angle of aperture of dry objectives. Place a microscope on a table or board, screw the objective in place and turn the tube down to the horizontal. Take a lath or similar strip of wood, 2 or 3 feet in length, drive a pin or wire nail through one end and into the table directly beneath the front lens of the objective. Arrange a small candle on the free end of the lath, so the flame will be at the same height or level as the objective, and can swing around the objective as a center.

Swing the candle to the right until the field of view, seen through the microscope, is one-half illuminated, bisected vertically. mark the position of the candle on the table, repeat the operation on the left side, marking the position there. A line drawn from the centre pin to each marked point will show the angle of aperture, approximately, (usually a little too large), which can be measured with an ordinary protractor. Microscopes having a graduated circle on the mirror-bar, may have a wax taper fastened in the place of the mirror, and the angle, obtained as above, read from the circle. This angle of aperture bears a certain relation to N. A. The rule is, *the sine of half the angle of aperture=N. A.* for dry objectives. A table of numerical aperture has been calculated, and is published in Carpenter, and other works, also in several catalogues of optical instruments. This table gives the N. A., for any given angle of aperture.

Say, a dry ¼ inch objective was measured as above and found to include an angle of 110.° Reference to the numerical aperture table will show that a dry objective, 110°=N. A. 82. Obtained by the rule, *one half* of 110,°=55.° By reference to a table of natural sines, (found in works on trigonometry), the sine of 55°=82.

167. *How may I tell the thickness of a cover-glass by using the micrometer on the fine adjustment of the microscope?—B. E. R.*

Focus successively on the dust on the upper and lower surfaces of the cover-glass. For a mounted object hardened under pressure, search for a point in the object which requires the greatest elevation of the objective for precise focus. This point is presumably in contact with the cover, and the difference between this point and the dirt on the upper surface of the cover may be measured by the movement of the divided screw-head. The values of the divisions on the screw-head must be obtained by trial over covers of known thickness.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON, CLEVELAND, OHIO.

How to Produce Pretty Crystals of Borax.—Make a saturated aqueous solution of borax. Place a drop of this solution on the center of the slide. Set the slide on a window-sill where the draft will affect the slide. Let the preparation stand until

the mass is crystalized. Beautiful crystals suitable for an inch objective will be formed.

A Method of Mounting Perithecia of Erysiphe.—Remove the perithecia with a spatula and place them in the center of the slide. Cover them with hydrate of potash and let them soak for a few minutes. Then press them with a cover-glass and partially squeeze out the asci. Wash out the potash solution with a few drops of alcohol. Then flood with eosin. Wash out the eosin with sufficient alcohol. Then mount in benzole balsam. You will have a beautiful slide showing anceptacles, asci and spores. The spores will take the deepest stain and will stand out prominently.

Flower Crystals of Sugar.—Prepare two test tubes of saturated solution of sugar; one of alcohol, the other of water. Then mix the two solutions in a third test-tube, and when throughly mixed, place a drop in the center of a slide and let it rest until it becomes a hard homogeneous mass Then set this slide, thus prepared, on the top of a student's lamp shade. In the course of a short time, the flower crystals begin to develope. Leave the slide in that position until crystals have developed over the whole mass. The crystals are now very hard and permanent and may be mounted. View it with the polariscope.

Demodex folliculorum.—This is a parasite of the cebaceous sacs and of the hair follicles of the human skin, and is found on some of the lower animals, being the cause of mange in dogs. It is also called *Acarus folliculorum*, and *Entozoon folliculorum*.

Remove a little of the cerement, place it upon a slide, put a drop of castor-oil or of olive-oil on it, tease well with needles, cover with thin cover and examine with a quarter-inch objective. The parasite, which varies in length from 1-50 to 1-100 of an inch in length can then be easily seen, often alive. This parasite is the true Acarus, and has the typical number of eight legs; its abdomen is finely striated. They can be mounted by running a ring around the cover after being prepared as above directed. When mounted in glycerine, it shrinks up and become

entirely absorbed. If it is desired to isolate the parasite from the surrounding debris, do so by patient manipulation under an inch objective, then drop a fresh drop of oil, replace the cover and fasten it with a permanent ring.

CORRESPONDENCE.

Diatoms.—H. L. Smith, LL. D., of Hobart College, our best known authority on diatomaceæ has sold to Dr. F. E. Hodges, F. R. M. S., of Indianapolis, Ind., his entire library on that subject, his collection of thousands of valuable slides, more than 4000 bottles of cleaned diatoms; also, all of the large collection of diatomaceous earths without making any reserve.

The library has few if any equals, for it contains nearly every book and paper of value ever published on diatomaceæ, also much on desmids. It might be difficult to find another so valuable collection of material in all of the other public and private collections in America.

To Prof. Smith the scientists of the world owe much, for he devoted many years of patient study, as well as a fortune in money, to investigations which gave rich returns to science, but microscopical returns to his pocket.

Advancing years and his college duties, have made it impossible for him to continue the great amount of correspondence which was required, and which was not renumerative; but which in past years gave him pleasure; and as he had the opportunity to dispose of the entire collection to advantage to an enthusiast now in the prime of life, he has done so.

Dr. Hodges now has the choicest collection of valuable slides that I have ever seen.—E. H. G.

RECENT PUBLICATIONS.

An Introduction to the study of the Diatomaceæ. By Fred'k Wm. Mills. London and Washington: 8°, 250 pp., Price $3.50.

Heretofore, if one desired to take up the study of this group of plants, he was obliged to grope his way through a mass of irrelevant matter contained in the reports of societies, to buy large and expensive volumes, and to hunt up certain old and very rare books. This, he no longer need do.

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THE MICROSCOPE.

SEPTEMBER 1893.

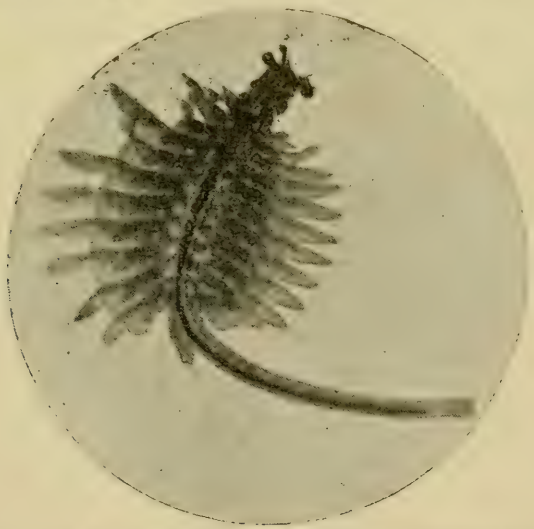
NUMBER 9. NEW SERIES.

OBJECTS SEEN UNDER THE MICROSCOPE.

1.—THE BRINE SHRIMP.

[PHOTO-MICROGRAPH].

The brine shrimp occurs in great numbers in the Great Salt Lake, which has usually been regarded as devoid of life. Dr. J. F. Talmage has kindly sent the accompanying illustration.



The mounting of this shrimp, *Artemia fertilis*, nicely, is by no means a simple undertaking, most of the ordinary media causing the delicate structure to become distorted, or producing such a transparency as to render the whole object invisible. The best method is to mount them in a preparation of lake water with corrosive sublimate and an alcoholic solution of carbolic acid. Into this fluid the living artemiæ are transferred directly from the lake brine; they die quickly, but in so doing spread themselves out most perfectly. By this method it is not always possible to get the mount free from foreign particles, but this is

but a slight disadvantage. Before mounting, make a very shallow cell of hot-paraffin and balsam, and after the cover-glass is in position, ring the edge with a very little of the same material, following this with repeated layers of cement, King's being preferred.

There is an interesting account of this animal in the *Microscopical Journal* for December, 1892, but the cut is recent. Dr. Talmage has forwarded the photo-micrograph from which this cut has been made by the photo-engraving process.

DE LA FACON D'OBSERVER AU MICROSCOPE,

OR, HOW TO OBSERVE WITH THE MICROSCOPE.

By M. F. LEMARDELEY,

[Translated from the French by Rene Samson.]

Does the microscope tire the eyes? Such is the first question which presents itself to persons desirous of observing the wonders of the unseen world. Let them be reassured. The use of the microscope, if our directions are followed, can but augment the sensibility of the eye by practicing it to perceive without difficulty the dullest tints and the most delicate details of structure. The conditions for working without the least fatigue are:

1.—Never observe immediately after eating.

2.—Open both eyes during study, for the fatigue that very many beginners experience is due to the effort made to keep one eye closed.

3.—Never use too bright a light.

4.—Work upon an unpolished and dark-colored table of such a height that the ocular will be on a level with the eye by bending very slightly.

HOW TO OBSERVE.—As has just been said, the place where one works ought to present an unpolished and dark surface. Any table which is a little heavy and covered with cloth or with very deep gray linen will perfectly answer the purpose. Black is not so good, for the minimum of fatigue comes at the moment when both eyes receive a nearly equal quantity of light. All the bright objects that one has at hand (oculars, objectives, etc.,) should be arranged so as not to attract the attention of the unoccupied eye.

If one observes during the day-light, he should place himself at 1 metre or 1.50 m. (3 to 5 feet) from the window and he should

utilize by preference the light of white clouds or that reflected from a wall. Blue sky does not permit any difficult observations. The sun should never be employed. In case it shines on the window, hang over it a thin white curtain which should produce an excellent light.

If artificial light is employed, use a lamp giving a white and absolutely fixed flame and one presenting the smallest surface possible. This condition is the only one which permits the most delicate observations. The light of incandescent lamps and of ordinary gas gives also some very good results but their use is less convenient and more tiring.

Illuminating the Object.—In this we have two cases to consider: (1) When the microscopist owns an instrument which is furnished with a condenser, and (2) when he has no condenser. We begin with the second case.

The microscope being placed at about 20 centimetres (8 inches) from the flame and so that the latter may be nearly on a level with the stage. Direct by means of the mirror the luminous rays on the preparation; use the plain mirror with very low power objectives, and the concave with ones of high-power. Regulate the quantity of light by means of the diaphragms. The higher the power of the objective the smaller the diaphragm ought to be and the nearer to the preparation. A too brightly lighted field is not only dangerous to the eyes, but even prevents seeing well, for the objects will be drowned in light.

If the objects that we examine present some fine details, pearls, striæ, etc., like Diatomaceæ, move away the diaphragms, or use the largest if it is a revolving diaphragm ; then incline the mirror to the right or to the left in order to obtain some oblique rays which project the image of finest details, exaggerating their importance and permitting us to perceive them better. The desired result is to see well with the least possible oblique light, for a too oblique light gives a badly illuminated field and brings about a distortion of images.

If the microscopist owns a condenser, Abbe's or any other with large aperture, he will not only have much more facility for ordinary study, but he will also be able to make some observations which would be impossible without this instrument.

For ordinary work with low-powers, one should employ the concave mirror, regulate the height of the condenser until the

image shows clean outlines, then regulate the light with the aid of the diaphragms placed under the optical system of the apparatus. In every case, when artificial light is used, one should place a lens between the lamp and the mirror, in order to obtain parallel rays.

If it is desired to resolve difficult tests with the aid of an immersion objective, raise completely the condenser, putting its surface in conjunction with that of the slide carrying the object by means of a drop of oil or glycerine or of the immersion liquid if one employs a homogeneous lens. This permits the use of very oblique rays which, without this precaution, would have suffered total reflection. It only remains now to diminish the intensity of the light by means of the diaphragms, if they are capable of being adjusted at different distances from the stage. Remove them from the axis in order to have the oblique light only on one side. If, with these arrangements, the object does not appear as is desired, take off all the diaphragms so as to expose completely the condenser, incline the mirror to the right or to the left, and when its position seems favorable, interpose between the lens and the instrument (very near the mirror) two thin metallic screens that can be brought near to each other more and more, until the moment when the extremities of the field begin to color. Then, almost always, at that moment, the least movement of the mirror is sufficient to bring out the most delicate details.

By this method, we easily resolve with the white light of a lamp, the *Navicula affinis* and even the difficult *Amphipleura*.

If one desires, the lens can be changed for a balloon full of ammoniacal sulphate of copper, which allows but one blue ray of light to pass. This is particularly favorable for the resolution.

However, in the majority of the cases. this disposition is useless for direct observation because of the important loss of light and of the facility with which one can pass through the field all the colors of the spectrum by simply bringing together the two screens above alluded to.

The study of certain colored bodies and particularly of the bacilli, is conducted with white light while leaving the condenser with its largest aperture and the mirror absolutely in the axis of the microscope. This is Koch's method. *Le Micrographe Preparateur*, *June*, 1893.

MODELS FOR CONSTITUTION AND BY-LAWS OF A MICROSCOPICAL SOCIETY.—II.

San Francisco, Cal.

This Society was organized on April 12, 1872, by 15 citizens of San Francisco. On August 30, 1872, it was incorporated under the laws of Califonia.

CONSTITUTION.

Article I.—Name and Object.

Section 1. This society shall be known as the San Francisco Microscopical Society.

Section 2. The object of this society is the promotion of Microscopical Science in all it branches, to be accomplished by the holding of meetings for scientific intercourse and discussion, by the reading and publication of papers relating to microscopical and kindred sciences, and by other suitable means.

Article II.—Members.

Section 1. The society shall consist of regular members, elected from San Francisco and its vicinity; life members constituted such by the single payment of one hundred dollars to the society; corresponding members, residing elsewhere, and honorary members, elected as such by reason of their eminence in science or attention to the microscope.

Sec. 2. None but regular and life members shall be entitled to vote or hold office.

Sec. 3. Candidates for membership must be proposed and seconded by two members, in writing, and their names posted in the rooms of the society at least two weeks before election, and a vote of four-fifths of the members present shall be necessary to an election which election shall be void if the party so elected fail to pay the required fee and sign the constitution within thirty days after due notification thereof.

Article III.—Officers.

Sec. 1. The officers of the society shall consist of a President, Vice-President, Recording Secretary, Corresponding Secretary, and Treasurer, who shall be elected annually as hereinafter pro-

vided, and shall hold office until their successors are elected and qualified. The offices of Recording Secretary and Corresponding Secretary may be held by the same member, at the discretion of the society.

SEC. 2. All elections of officers shall be by ballot, members present only voting. No member shall be represented by proxy. In case there should be no choice on the first ballot, all candidates except the two having the highest number of votes (or, in the event of a tie, the three highest) shall be dropped. The majority of all votes cast shall be necessary to a choice.

SEC. 3. The officers of the society, together with the last two living ex-Presidents residing in San Francisco or its vicinity, shall constitute a Board of Trustees, which shall have the general management of the society's business affairs, and the care and control of its property; shall appoint all subordinate officers and exercise all powers and perform all duties of a Board of Management necessary to sustain and carry on its operations. They are authorized, whenever in their opinion it is deemed advisable, to loan any instrument or materials to any member, upon receiving from such member the actual cost price of the same: such instruments or accessories to be returned to the society when required by said officers, together with proper compensation for their use.

SEC. 4. The President, or in case of his absence or inability to serve, the Vice-President shall preside at the meetings of the society and of the Board of Trustees; he shall appoint standing committees and supervise the general business of the society; he shall make a report of the condition and progress of the society in all its departments at the annual meeting, and, at his pleasure, bring to its notice any important events of interest to it. In the absence of both President and Vice-President from any meeting, a chairman *pro tem*, may be chosen, who shall preside at such meeting.

SEC. 5. The Recording Secretary shall keep a record of the Board of Trustees; receive the papers read before the society, and prepare them for publication by combining them with his reports for the press; he shall give suitable notice of time and place of meetings of the society; keep a duly classified list of the members, and attend to such other business in his department as the Board of Trustees may direct.

SEC. 6. The Corresponding Secretary shall attend to the distribution of the publications of the society to regular and other members entitled to the same; conduct correspondence with societies and individuals; notify members of their election and furnish them with diplomas.

SEC. 7. The Treasurer shall attend to all receipts and disbursements of the society, giving such bonds and furnishing such vouchers as the Trustees may require; collect all dues from the members, and keep an accurate account of the receipts and disbursements; furnish the Trustees from time to time, as they may require, with a list of members entitled to vote; and make a general report to the society at the annual meetings. The Treasurer shall pay no bill against the society unless the same has been approved by the Auditing Committee.

SEC. 8. The President shall, at the first business meeting after the annual in each year, or as soon thereafter as possible, appoint,— first, an Auditing Committee of three regular members, whose duty it shall be to examine and approve all bills against the society; second, an Exhibition Committee of three members, whose duty it shall be to make all arrangements and take charge of the public or other exhibitions of the society.

SEC. 9. The Trustees shall have the power to appoint a Curator, who shall have charge of the library, instruments, and collection of objects, and who shall enforce such rules for their management as may be prescribed by the Trustees. He shall furnish a report of additions to and condition of the library, instruments, objects, microscopic material, etc., to the society at the annual meeting.

SEC. 10. In case any office shall become vacant from any cause, the fact shall be announced to the society by the President, and an election to fill the vacancy shall be had at the next meeting after such announcement shall have been made.

ARTICLE IV.—MEETINGS.

SECTION 1. The annual meeting, for the election of officers and other business, shall be held on the first Wednesday in February. Stated meetings, for microscopical research, shall be held on the first and third Wednesdays of each month. Special meetings may be called at any time by the President or by any two officers. Notice of annual and special meetings shall be sent to each regular and life member, or by advertising, if so directed.

Sec. 2. Meetings of the Board of Trustees may be held at any time and place, at the call of the President. The President shall also call a meeting of the Board of Trustees whenever requested to do so by any two members thereof. Three trustees shall constitute a quorum for the transaction of business.

Sec. 3. Five members shall constitute a quorum for the transaction of business at any stated or special meeting, and seven members shall constitute a quorum for the transaction of business at the annual meeting.

Article V.—Fees and Dues.

Section 1. Regular members shall pay an initiation fee of twenty dollars, and one dollar per month dues. Regular members desirous of becoming life members can do so upon the payment of seventy-five dollars

Sec. 2. Any regular member in arrears for dues more than three months, except in case of absence from the state, shall be notified in writing by the Treasurer, and if his dues remain unpaid for one month thereafter, his name may be dropped from the list of members.

Sec. 3. All money received for life membership shall constitute a special fund, to be invested by the Board of Trustees, and only the income derived therefrom shall be used for current expenses. This fund shall not be used for any purpose without a vote of two-thirds of the members present at a stated or special meeting, and notice of such intention having been given in open meeting at least two weeks previous.

Article VI.—Publications.

Section 1. The permanent publications of the society shall be directed by a Committee on Publications, under the general supervision of the Trustees.

Sec. 2. Each regular, life, and honorary member shall receive, free of cost, one copy of all publications issued by the society during membership.

Article VII.—Amendments.

Section 1. Amendments to this constitution may be made at any annual meeting, without notice and at any stated or special meeting called for the purpose, upon notice of two weeks, stating the substance of the proposed amendments.

Sec. 2. All or any part of this Constitution may be sus-

pended at any meeting, by a vote of two-thirds of the members present, notice of such intention having been given at least two weeks in advance.

ORDER OF BUSINESS.

1.—Reading of Minutes; 2.—Applications for Membership; 3.—Election New Members; 4.—Reports of Committee; 5.—Additions to the Library; 6.—Donations to the Cabinet; 7.—Unfinished Business; 8.—New Business; 9.—Written and Verbal Communications.

HAIR-PIN CLIPS.

By O. H. HUBBARD, M. D.,

WALPOLE, MASS.

Among the many handy home-made instruments which I have devised since I began microscopic work, some made from ladies hair pins have proved very useful and satisfactory. Needing a large number of spring clips, I purchased five cents worth of medium-sized hair pins and with a pair of pliers bent one leg of the pin as in fig. 1, the other leg was then shaped as in fig. 2.

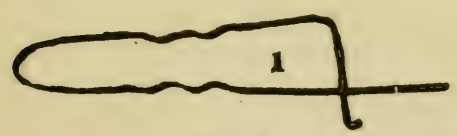


Fig. 1.

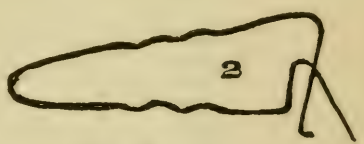


Fig. 2.

In using, the edge of the slide is placed on the side of the V shaped lower limb. The upper one is raised and the slip is then slid under it far enough to allow the point of the upper limb to rest on the center of the cover glass. The pressure can be varied by bending the angle of the pin.

PRACTICAL HINTS TO WORKERS.

By F. L. JAMES, M. D.,

ST. LOUIS, MO.

Do not throw away alcohol and benzol that you have used for washing or other purposes, and which is not sufficiently pure to return to the container. Have a pint bottle with a glass stopper at hand, and pour these little residues into it. When it is, say half full, scrape up some castile soap and put into the bot-

tle. Add an ounce of strong ammonia water, or half that quantity of liquor potassæ, shake up, and you will have a liquid soap that will remove from the hands or clothing any of the gums, cements, etc., used in mounting. Even marine glue yields to it like magic.

Sharpening the little knives used in minute dissections is one of the most difficult things to even old workers, and yet one of the simplest imaginable after you get the hang of it. I use for this purpose three hones—a quick-cutting, somewhat coarse, barber's hone (those backed with slate are best), a fine hone of the same sort, and lastly, the finest Ouachita (Hot Spring) hone. Soap and water, or lather, is used to keep the hone wet. If the knife is quite dull, commence with the coarse hone. Lay the blade perfectly flat on the stone and move it, edge foremost, straight over the stone, being careful to carry the hand with it in such manner that the blade shall remain flatly in contact with the hone the entire distance. This is the first secret of success, and you will find it somewhat difficult to accomplish at first; but with a little care and attention the movement soon becomes automatic. Do not bear or press on the blade. This is the second essential point. Let the blade slip lightly over the stone, in exact contact, but exert no undue pressure. If you do, the blade bends at some point and wears away there, instead of somoothly all along the surface. Having removed sufficient of the metal and secured a roughly-sharp edge, take the second or smooth hone, and proceed in the same manner, keeping plenty of lather on the stone. One way of judging whether your blade is laying quite flatly on the surface is to note whether it moves the bubbles of lather to one side or the other, or whether it slips under them, leaving them in place. The latter is the way it should do. A few passes on this stone will be sufficient. The finishing on the Arkansas hone is performed in the same manner, only greater care should be exerted to prevent any pressure. When the knife comes from this hone it should be bright and polished almost as smoothly as though it had been against a polishing buffer. It is now ready for use. A strap for such knives, indeed, for any knife, is an abomination. It simply rounds and dulls an otherwise perfect, wedge-like edge. If a point has been broken off restore it on the coarse hone first, before you commence to sharpen. To this end, pass the blade, if

very delicate, through a cork that has been rudely squared so as to afford a finger-hold and to serve as a guide for the proper position in which to hold the blade. Holding the latter, edge downward, on the stone, move it lightly backward and forward with a scraping motion until you wear off sufficient metal. Examine, from time to time, to see whether you are getting the proper shape to the point. Repeat the operation with the back of the knife downward. After you have sharpened the blade on the rough hone you can sharpen the curved edge of the point. Beginners had better replace the cork for this operation, leaving just sufficient of the blade exposed to rest firmly and smoothly on the hones. If there are gaps along the edge remove these, too, before beginning to sharpen. This is done by holding the edge perpendicularly on the stone and scraping backward and forward until the entire edge is worn back to the depth of the gap. This keeps the edge true and straight.

It sometimes happens that one wishes to use a bottle in a great hurry, and a clean, dry one is not at hand. If you wash out a bottle in the ordinary way, it takes a good while to dry completely. If you want to put, say a solution of dammar, or benzol, or zinc cement into it, it must not have a single drop of moisture in it. I will tell you how you can use it in a half minute after rinsing. Shake out all the water that you can get rid of by swinging the bottle, mouth downward, to and fro. Then go to your alcohol jar, fill your bottle quite full of alcohol, and pour it back into the jar. The residual drop or two of water will not materially lower the strength of your stock. Shake out the few residual drops of alcohol and repeat the same operation with absolute alcohol, returning the latter to your stock. Then if you are very particular, you may proceed in the same way, using benzol as a rinser. The bottle is then clean, ready to be filled. The same process may be followed with a sable pencil, a costly brush or article of that sort that has been used in an aqueous medium, and you wish to transfer it at once to an enamel or cement bottle. Wash it in water to get rid of the medium, rinse first in water, next in alcohol, then in absolute alcohol, and finally in benzol. If it has been in some gummy or oily material and you wish to use it in an aqueous or other medium, wash it with the liquid soap described above, rinse with clear water, and it is ready for use again.—*National Druggist.*

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Prices of Drugs.—The average price of drugs is 3½ times as much in the United States as in Denmark. What costs 75 cents in New York can be bought in Copenhagen for 20 cents. In Norway, Sweden, Belgium, Germany, Austria, Holland, Hungary, Switzerland, and Portugal, the prices of drugs average less then half what they average in the United States.

Pork Packing.—One firm in Chicago, during 1892, packed the meat from 1,189,498 cattle; 1,134,692 hogs; and 1,013,527 sheep. The sales amounted to $90,000,000. We have written to the firm to ask what microscopical methods they employ for detection of trichinæ and other diseases affecting meat and hope to be able to publish an interesting account.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

168. *Explain how to centre and use an Abbe condenser so as to get the best illumination for ordinary objects and bacteriology?—B. E. R.*

A condenser is centered by means of a cap, with a small central perforation, slipped over the top lens. Use the plane mir-

ror for light, and an inch objective focussed on the perforated cap. Move the condenser about until the perforation is exactly in the centre of the field, then secure it. Practice with familiar objects, like blood corpuscles, diatoms, etc, until the effect of various openings and positions is known. Central light is the rule for histological work. When using high-angled objectives, as in bacteriology, make immersion contact with glycerine or hom. imm. fluid between the top lens of the condenser and the lower side of the mount. With high-angled objectives, there is no such breaking-down of the images under a flood of light as may be seen ordinarily with the low-angled objectives. With the latter, delicate details require a dimmed light producing a dim, uncertain image. With the former, a much brighter light can be employed and sharp, crisp details enjoyed.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON, CLEVELAND, OHIO.

Mounting Cyclops.—It is desirable to mount *Cyclops quadricornis* so that the egg sacs will be preserved. With patience, time, and perseverance, it can be done.

Begin by first preparing the slides with white-zinc rings. Lay them away until the rings are dry and hard. When the slides are thoroughly seasoned, place a Cyclops within the ring and a cover glass on the ring, thus enclosing the Cyclops with a ring full of water under the cover. Make a mounting fluid by mixing one-half lime water and one-half glycerine. Run the lime mixture under the cover at one side and soak out the original water at the other side with a piece of blotting paper. The reason for using lime water with the glycerine is, that the Cyclops is composed largely of carbonate of lime which pure glycerine will dissolve and destroy. Make a white zinc ring so as to fasten the cover temporarily. Set it away to dry and harden and in a day or two add another ring, repeating successive rings until a properly finished ring is made. It may take a week to finish a slide properly, but prepared in this way, one cannot fail to succeed. Undiluted glycerine will cause the Cyclops to disappear. This method, was invented by Mr. Montague Rogers, of Cleveland, and it brings this Entomostracan into a natural position with horns and egg bags extended.

From March until September, the Cyclops appear in great numbers in Lake Erie, and are plainly visible to the unassisted eye, so that one can pick them out with a spoon, or with a dipping tube. From a glass full of Lake Erie filterings, which can be replenished weekly, one can always secure specimens.

The Pollinia of Milkweed.—These pollen masses of the milk-weed or silk-weed make beautiful slides. Under illumination from the mirror, they resemble plates of gold. Remove the pollinia from the stamens with a needle and place them on a slide. A few minutes practice will make one expert. Mount at once with benzole balsam.

Spiral Cells of the Castor Oil Plant.—The spiral cells of this plant can be easily obtained and mounted. Take one of the dry stems, after the plant has withered in the fall. The long perpendicular fibres which may be readily stripped out from the inner side are the spiral fibres. Strip out a sufficient quantity to make a slide and trim them; then stain with carmine, or other suitable stain, and clear with alcohol. Let them dry on the slide and mount in balsam. The fibres will curl up and appear as a lot of beautiful ringlets.

White Zinc Mounting.—Very perfect mounts may be made with white zinc. Procure a tube of white zinc from a dealer in painters' supplies, and from the same source obtain a bottle of prepared linseed oil. Mix a sufficient quantity of the zinc and oil to make the number of slides you desire, and prepare it as if for painting. When well mixed, and of a proper consistency to flow readily, run rings on the slides with a fine brush. Then, with a knife point perfect the rings on the turn table. Set the slides away to dry; keep them flat, and free from dust. A dry mount may be made with one of these cells by placing the cover on the hardened ring and cementing it by heating a plain slide and placing it over the ring until a narrow margin runs under the cover. Then run any suitable outside ring. A ring prepared as above and thoroughly dried and hardened will hold glycerine many years. To use with glycerine, fill the cell, put the cover on, and then run a slight ring of white zinc. Set it away to dry. The next day run another ring. Dry it 24 hours, and so on, until the outer ring is good.

Finish these outer rings at the time of putting them on, by running them upon the turn table with the point of a penknife.

SCIENCE-GOSSIP.

Method of Mounting Calcified Microscopic Specimens.—Mr. J. Mansbridge finds the one great disadvantage in the use of fluid balsam as a mounting medium for calcified specimens, where it is advisable to retain the air in the structure for purposes of clear definition, is the liability to run into any spaces, such as lacunæ or tubuli that may exist in the tissue. To overcome this difficulty, he uses dessiccated balsam in the following way:—Take a clean slide, place it upon a hot table with a small lump of balsam upon it, and cover with a hot cover glass, which must be pressed down in such a way as to expel all air from beneath it. Remove the slide to a cool surface and continue to keep pressure upon the cover glass for a few minutes, when the balsam will be found to be quite hard and the specimen ready to be labelled and to be put away. He finds the advantages: (1) There is no chance of the mounting medium running in and spoiling the section, as it becomes perfectly hard a few minutes after removal from the hot table (2) The specimen is finished at the time and is ready for the cabinet. There is no need to use a clip, no fear of the cover-glass shifting if the slide is placed upon its side. (3) It is very convenient for teaching purposes, as the ordinary stiff balsam soon gets into a most deplorable condition.—*Trans. Odont. Society.*

To Make Gold Crystals.—Get some neutral terchloride of gold and make a solution of about ten per cent in strength; put into it a piece of zinc, and you will see an immediate outgrowth of black metal, then the gold will push forward in lichen-like masses, green, lilac, or yellow, followed, perhaps, by yellow or black fringes, and ending in delicate aborescent forms. A yellow branch will often run rapidly around the edge of the drop. The gold salt is also apt to crystallize on the glass plate in long needles and the metallic fronds follow up these long crystals which disappear before them as though devoured by their advancing points.—*Boston Journal of Chemistry.*

To Take Aniline Stain Out of Cloth.—Dissolve one part of Sodium Nitrate in two parts of dilute sulphuric acid and 75 parts of distilled water. Let it stand over night. Apply gently and rinse carefully.

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THE MICROSCOPE.

OCTOBER, 1893.

NUMBER 10. NEW SERIES.

OBJECTS SEEN UNDER THE MICROSCOPE.

2.—HEAD OF A TAPE WORM.

[PHOTO-MICROGRAPH.]

The tape worm is one of the Entozoa and is called *Tænia crassicolis*. It is to be found in the intestines of many kinds of animals, the present illustration having been derived from one

taken by Dr. Talmage from the liver of a rat. We call this "the head" of the animal because it is at the end where a head ought to be and because it is the organ nearest approaching a head. But one will search in vain for eyes, nose, ears or mouth. The prominent feature consists of the 30 to 40 projections which, in the picture, look like horns; but which, like tentacles, simply enable the animal to attach itself to a place where it can obtain nutriment. We say nutriment, and not food, because having no stomach, it cannot digest food. It takes in through the pores of its body, the nutriment its host has prepared for itself.

SIXTEENTH ANNUAL MEETING OF THE AMERICAN MICROSCOPICAL SOCIETY.

HELD AT MADISON, WIS., AUG. 14 AND 15, 1893.

Monday, August 14, 1893.

The American Microscopical Society held the first session of its annual meeting in science hall, at University of Wisconsin, commencing at 10 o'clock. The attendance was small, owing partly to the attractions of the World's fair, partly to the fact that most of the members reside east of the Alleghanies. The following new members were elected: Miss Edith J. Claypole, Akron, O.; Henry C. Bennett, New York City; James C. Gregory, Nyack on Hudson, N. Y.; Herman Schrenck, New York City; Agnes Winslow Foster, Brewster, Mass.; Dr. Wm. H. Knap, Chicago, Ill.; John H. Madden, Chicago, Ill.; B. N. Werum, Toledo, O.; John D. Locke, Haverhill, N. H.

The society voted to publish 500 copies of its proceedings next year. The committee on universal screw reported progress and was continued. It was also voted to add abstracts of American microscopical work to the proceedings. The local committee gave an invitation to an excursion on Lake Mendota Tuesday evening, which was accepted. It was decided not to give a soiree this year. In the afternoon the society listened to an elaborate description by Prof. W. S. Miller, of Wisconsin University, of the methods of reconstruction of the lung from thin serial sections, many hundreds of which are made about two-hundreths of a millimeter or one twelve-thousandth of an inch in thickness, and sheets of wax one-twelfth of an inch thick or 100 times as thick, which are cut out like the sections, only 100 times as large, and are piled on one another till a part of a lung is modeled on a scale 100 times the size of the actual organ. Thus the real construction is made much more familiar to the mind of the student. Other organs may be made in the same way.

In the evening at 8 o'clock, the members of the association met in the assembly chamber of the capitol with a goodly number of Madisonians. Short addresses of welcome were made by Mayor Corscot on behalf of the city, General Lucius Fairchild, chairman of the local committee and President C. K. Adams on behalf of the university. Hon. J. D. Cox, introduced them.

After the addresses of welcome, Prof. Jacob D. Cox, of Cincinnati, Ohio, President of the American Microscopical Society, read a paper entitled: Why the Technique of the Microscope and its Accessories Should Systematically be Taught in Our Universities. Mr. Cox is dean of the law school of Cincinnati college. He was governor of Ohio in 1866 and 1887 and was Secretary of the Interior in President Grant's cabinet. His paper, while necessarily technical to a degree was from time to time embellished with illustrations of microscopical achievements which made it highly acceptable to a popular audience. He urged the desirability of a somewhat extensive course of technical instruction and training in regard to the microscope, backed by so ample a collection of stands, of objectives and of accessory apparatus as shall give the university student the opportunity to judge for himself under the guidance of a competent instructor. of the practical value for general or for special use of the various forms of instruments of different types. The proper procedure in selecting instruments, etc., was dwelt upon The apparatus necessary for the thorough prosecution of microscopic work is so expensive that there is scarcely an individual who can make a collection of kinds which is anywhere near complete; so for the best results to be obtained some large organization like our great universities must take up and prosecute the work. He pointed out wherein microscopic research is becoming a real necessity in the various pursuits of daily life and wherein the facilities for research could be vastly improved. There is an undeniable field for instruction in the technique of the instrument and its accessories, said Mr. Cox. There is room for further improvement in the microscope itself and everything connected with it. There is need for a place where the worker may find everything of value which has been invented or devised, and an opportunity to learn or to test its value by actual comparison or in use. If our universities will furnish the plant and the instructors, they will do, in a better and more thorough way, what the microscopical societies of Europe and America have been trying to do; or perhaps will make only more satisfactorily clear the advantage to science of such societies, by giving to every student the ground work which will ensure not only his progress but his lasting interest in these technical studies. At some length the speaker then analyzed the lines of

work which open to the microscopical student, and of the questions in technique or in construction which may fairly be said to be still undecided. Then followed a very interesting story of the use of the microscope in the hands of all users from the novice to the expert. Mr. Cox pointed out a hindrance to the rapid advancement of microscopical science which applies as well to the advancement of other movements. It is the tendency to follow leaders too closely. In microscopy, Mr. Cox said, the remedy for this is the opportunity for proving all things by the systematic study of technique under favorable conditions. A fresh, bright mind in a laboratory, when encouraged to use his own ingenuity, is constantly surprising us by the fertility of his invention and the rapid progress he will make. Give him the same opportunity in comparing the merits of his instruments and apparatus. Supply him with good examples of all the different styles and kinds. Free him from bondage to any tradition and stimulate him to use his own powers here as you do in pure science, and I cannot doubt he will surprise us, not only with the justice of his choice, but with still greater improvement in all that makes investigation with the microscope sure and easy. In closing Mr. Cox emphasized the point that the university is the proper place to advance this work and called upon the society of which he is president to do all it can in seeing that the desired end is accomplished.

Tuesday, August 15, 1893.

The American Microscopical Society reassembled at a few minutes past 10 o'clock Tuesday morning and proceeded to elect the new members.

The following named persons were elected to membership: Michael V. Ball, Philadelphia, Pa.; Enoch Mather, Paterson, N. J.; Thomas Craig, Brooklyn, N. Y.; May Fischer, Jena, Germany; James C. Ternan, Rochester, N. Y.; John E. Davies, Madison, Wis.

A committee was appointed to nominate officers for the ensuing year as follows: Wm. A. Rogers, Wm. H. Walmsley, E. Bausch, R. H. Ward, M. D. Ewell. The society decided hereafter that it would apply the word "exhibition" to its evening entertainments, in place of the word "soiree," and that the exhibition would be dispensed with this year.

The committee on prizes for microscopical investigation appointed last year reported the awards as follows. One prize of $50 to Miss Edith J. Claypole, of Akron, Ohio, for her examination of the blood of Necturus and Cryptobranchus; one prize of $50 to Herman Shrenck, of Brooklyn, N. Y., for his investigation of the parasitical relations of epiphegus, or beech drops, a plant without chlorophyl, growing on the roots of beech trees (both of these essays were theses for a degree from Cornell University and were copiously illustrated by numerous beautiful drawings); one prize of $20 for six microscopic slides, illustrating the structure of the human spinal marrow, by Wm. C. Krauss of Buffalo, N. Y.

Prof. W. W. Rowlee, of Ithaca, N. Y., read a paper on the aerating roots of *Mikania scandeus*, a climbing plant belonging to the Composite on the banks of streams, and throwing fine roots upward from its main roots, the sole object of which appears to be to convey air to the interior of the root system.

In the afternoon the society listened to a demonstration of the use of apparatus for photomicrography by Dr. A. C. Mercer, of Syracuse, N. Y., and continued by Prof. S. H. Gage, of Ithaca, N. Y., W. H. Walmsley, of Philadelphia, and others.

LIST OF PAPERS ENTERED FOR PUBLICATION.

The following papers were laid before the society on Monday and Tuesday August 14 and 15.

A spectroscopic study of colored inks, by M. D. Ewell.

A metric study of 2000 check signatures, by M. D. Ewell.

A steel bar plated with Iridium for micrometric purposes, by M. D. Ewell.

The simplification of laboratory methods, by Wm. C. Krauss.

The minute structure of certain aerotropic roots, by W. W. Rowlee.

Progress in investigation of diatom structure. Some new photomicrograps by T. H. Smith of London, by Jacob D. Cox.

Some points in the history of a new Distoma, by Henry B. Ward.

The arrangement and structure of the muscles of the Lamprey (Petromyzon), by S. H. Gage.

Sarcina ventriculi in medico-legal investigations of blood stains, by W. N. Sherman, M. D.

A new clearer for collodion, by Pierre A. Fish.

On the blood of Cryptobranchus and Necturus, by Edith J. Claypole.

On the structure of the teeth and bones of Paleozoic fishes, by E. J. Claypole.

The action of leucocytes towards foreign matter, by Miss Edith J. Claypole.

The effect of acid urine and solutions of chromic acid on red blood corpuscles, by M. L. Holbrook, M. D.

On sectioning fern prothallia, and other delicate tissues, by Mason B. Thomas.

Parasitism of the Broom rape on beech roots. Epiphegus on Fagus, by Herman Shrenck.

A contribution to the study of the Myelin degeneration of pulmonary alveolar epithelium, by Veranus A. Moore, M. D.

A plea for the study of reagents in micro-work, by V. A. Latham.

OFFICERS ELECTED FOR 1893-'94.

For President, Dr. Lester Curtis, Chicago, Ill.
Vice-Presidents, Prof. W. W. Rowlee, Ithaca, N. Y.
Prof. W. S. Miller, Madison, Wis.
Secretary, Wm. H. Seaman, Washington, D. C.
Treasurer, C. C. Mellor, Pittsburg, Pa.
Executive Committee, Dr. Lyman Deck, Salamanca, N. Y.
Dr. V. A. Moore, Washington, D. C.
Prof T. D. Biscoe, Marietta, Ohio.

COLLECTING DIATOMS

By F. W. MILLS,

HUDDERSFIELD, ENGLAND.

[Chapter VII, of his "Introduction to the Study of the Diatomaceæ."]

The diatomist has not far to turn in quest of objects for collection and preservation. As has already been observed in the first chapter, this class of microscopic life is almost universal. It may be met with in fresh, salt, or brackish water in a living state, and large beds of frustules in a fossil state exist; as for instance at Dolgelly. Our mountain streams, lakes, ponds, and ditches contain vast numbers of specimens, which may be collected all the year round. Oyster beds abound with them, and the stomach of almost every fish will yield a good supply.

"Their living masses," says the Rev. W. Smith, "present themselves as coloured fringes attached to larger plants, or forming a covering to stones or rocks in cushion-like tufts (or spread over the surface as delicate velvet), or depositing themselves as a filmy stratum on mud, or intermixed with the scum of living or decayed vegetation floating on the surface of the water. Their color is usually a yellowish-brown of a greater or less intensity, varying from a light chestnut in individual specimens to a shade almost approaching black in the aggregated masses. Their presence may often be detected without the aid of a microscope, by the absence in many species, of the fibrous tenacity which distinguishes other plants. When removed from their natural position they become distributed through the water, and are held in suspension by it, only subsiding after some little time has elapsed."

The Diatomaceæ have been divided into two classes, by Herr Johann Nave, viz.:—the free species, or those which have an independent existence; and the stipate, or such as are attached to other objects, generally Algæ, by means of a stalk. There is however a third division comprising the frondose species, or those in which numerous individual frustules are enclosed, held together by a gelatinous mass, and in appearance not unlike sea-weed.

The free growing species are found entangled with algæ and mosses, or below the surface of the water, wherever the soil, stone, or a fallen leaf is stained with a yellowish brown hue. In rapid streams and mountain torrents they become scattered and numbers of them remain suspended in the foam and may be easily gathered. Also when the sun is shining they liberate oxygen and rise to the surface with the gas. Whenever these minute bubbles are seen to be coloured brown, it may be taken as a sure sign that Diatoms are present.

Certain stipate Diatoms are exactly similar to others of the free kind so far as their frustules are concerned, and their stipate existence forms a convenient basis for distinguishing the families.

As examples of the very close approximation in the form of the frustule may be mentioned, the *Cymbella* and *Cocconema*; *Sphenella*, and *Gomphonema*, which are respectively separated solely on account of this difference.

Stipate Diatoms may be found adhering to the larger algæ and similar water plants, tinted with a reddish brown.

When collecting, a number of phials with wide mouths, furnished with corks, should be carried. The mouth of the bottle being closed with the thumb it is brought close over the coveted colony in the water, and on removing the thumb, the water and Diatoms will rush in. A spoon is frequently used in removing layers of Diatoms from sand at the bottom of pools and rivers. If the masses of Diatoms are entangled amongst algæ, they may be detached and collected by means of muslin nets affixed to a rod. Telescopic rods, like Japanese fishing-rods can be procured for carrying the net or a bottle, and are often useful in obtaining specimens which would be otherwise beyond reach.

Diatomaceæ are, as has already been stated, found in fossil form in great numbers, seldom however containing a great variety of species. The mass may sometimes be disintegrated by placing lumps of it in a test-tube, covering them with *Liquor potassæ*, boiling for a short time until the whole breaks up into a sort of mud, which should instantly be poured into a quantity of distilled water and well washed.

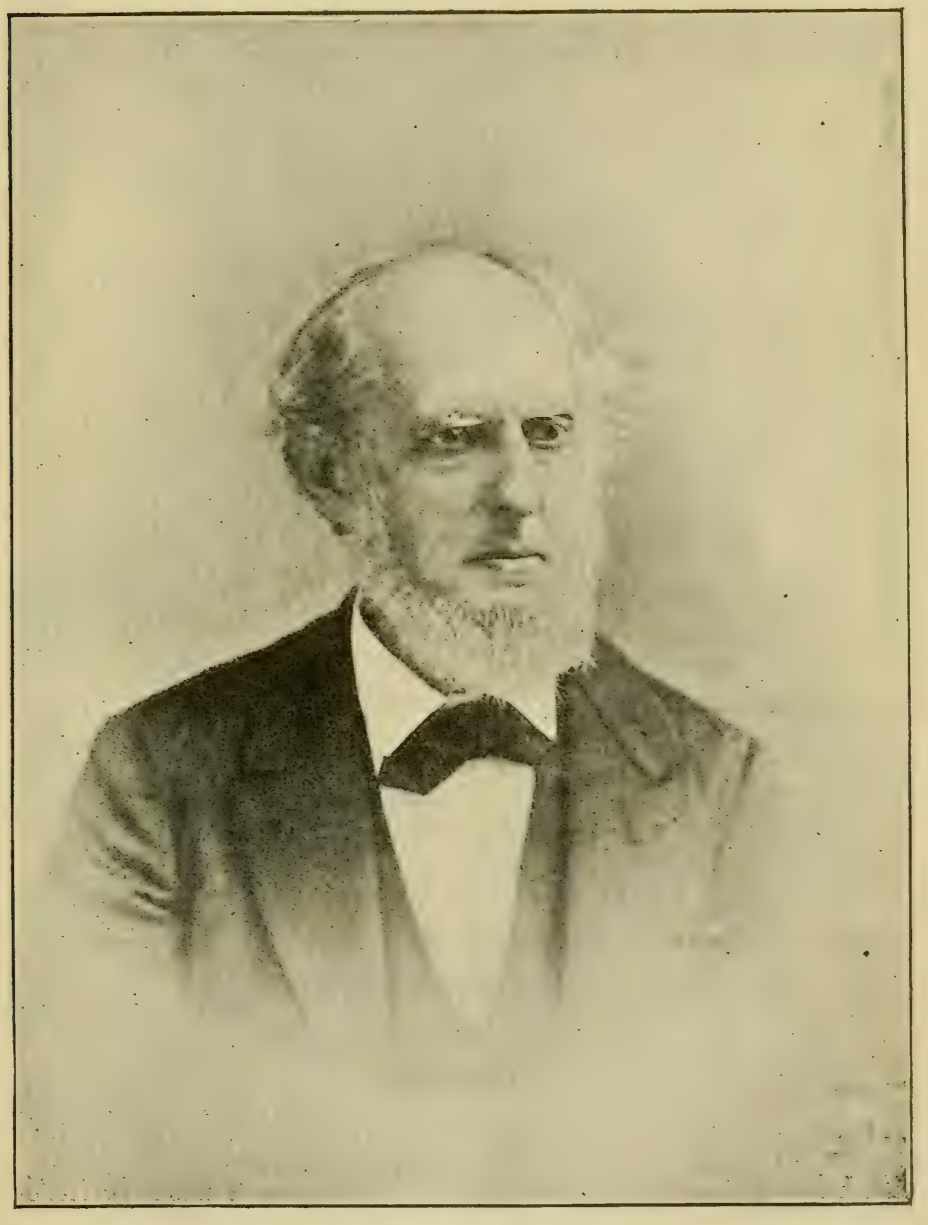
THE INVENTOR OF THE FIRST PAPER BAG MACHINE.

By R. G. DUBOIS, WASHINGTON, D. C.

[FROM THE INVENTIVE AGE.]

The man who produces a useful invention does more for humanity than the discoverer of a planet. The Rev. Francis Wolle was the first man in the world to invent and build a machine for making paper bags. Before his day, paper bags were made by hand and were too costly for ordinary use, being held in reserve for the more expensive class of goods, but after his invention they became more commonly used than ordinary sheets of paper. If we should aggregate the time saved to each waiting customer in a store, by the use of bags instead of the old sheet folding process, it would amount to enough to build forty railroads around the globe. Dr. Wolle was born in 1817, and when about sixteen years of age was employed in his father's store at Bethlehem, Pa. While engaged there the idea of making paper bags by machinery first entered his thoughts, but

not until 1850 was he able to put the ideas of former years into practical shape. After 14 years constant work in the school room, his health failed and he sought recreation in the work of



REV. FRANCIS WOLLE.

constructing a paper bag machine. In 1852 he received his first patent, and he built a few machines in 1855. He then went to Europe where more patents were procured. His brother was with him constantly giving financial aid. After seven years

devoted to putting the machine on the market, and spending about fifty thousand dollars defending his claims, he sold all his interests in the inventions, gaining financially very little. After disposing of his patents he returned to educational work, and became principal of the Young Ladies Seminary at Bethlehem, Pa. Resigning the position in 1881, he gave his entire time to the study of botany, after which he became the author of several botanical works. His busy and useful life ended February 10, 1893.

THE TARIFF ON SCIENTIFIC BOOKS.

By J. EDGAR BULL,

NEW YORK.

In every controversy both sides are partly right and both are partly wrong. This is the fundamental character of controversies and a partisan who fails to see any justification for the convictions of his adversaries may safely write himself down as unworthy of respect. A conclusion, if worth anything, is a balance struck between opposing reasons; and as to the wisdom of imposing a tariff on scientific books, I, for one, have not yet struck the balance. But I have some suggestions to make.

Scientists as a class are public benefactors. They give far more than they receive. Of course, to those who can see in the tariff only a tax on scientists, the question is simple enough. To those who see in it more, the question is rather complex. Any plan that would increase scientific investigation in this country should be adopted. But supposing that—as we are told—owing to cheaper labor, cheaper material and lower rates of interest, books published in London can be sold here for less than those published in New York; might not our scientists who wish to publish something, be deprived of some part of their small incomes; if they are without protection might we not miss the stimulus of individual and national effort; might not American science suffer? I do not say it would—I merely ask the question. Scientists must live and must earn dollars. If their opportunity to publish be dimished, will American science be the gainer or loser? The effect of a national literature cannot be estimated in dollars and cents, but it is not easy to overestimate it.

Some of these remarks do not, perhaps, apply to the publication of purely original investigations; but those are in pages, not in volumes; and are addressed, except in periodicals, to a very limited audience. The dilitante are to the scientific in numbers as hundreds to one. I, a useless dabbler myself, speak, I think, for the vast majority when I say that if some part of the extra price we have paid for American scientific literature has found its way into the pocket of the needy author, or has made publication possible for what would otherwise have remained in manuscript, we are satisfied. It is little enough to ask of us. Science cannot flourish in any country without artificial encouragements. If it were not for the princely munificence of private individuals who have endowed our educational institu tion and kindred enterprises we would not have any purely scientific men worth speaking of, because theirs is not a money-making business. The greatest scientists are not the greatest book-worms. Those who read most discover least. It is desirable to encourage not absorption, but investigation. I doubt if the cause of science ever suffered because an original investigator did not have money to buy more books. Those who would derive pleasure or profit from the discoveries of others are the great book-buyers and why not let them pay for them? At the highest they do not give anything like what the information costs, or is worth. My preference is for increasing the author's royalty instead of cutting down his market.

Before the passage of the new copyright law we were at liberty to republish English works without paying a copper for the brains that were in them. Of course, the effect of the law is to increase the price of certain books and yet I suspect that even the editor of this periodical favored its enactment. If he did, he must admit that cheapness is not after all, the only element to be considered.

To Mount Volvox.—Prepare a medium as follows: Copper acetate 8 grains, glycerine 4 oz., camphor water 2 oz., glacial acetic acid 10 drops, water 2 oz. Mix these ingredients and filter the product, mount as usual.

To Mount Fresh-Water Algæ.—Take acetate of potash 1 part, water 2 parts, mix. If crystals form add more water. This medium will not destroy the chlorophyl.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Diatomaceæ and the Paper Bag.—We quote elsewhere a short article from *The Inventive Age* in which has been published a kind notice of the Rev. Francis Wolle's career as an inventor In the *Microscopical Journal* has already appeared a notice of Mr. Wolle's work upon the Diatomaceæ and upon the Algæ. A man who at the same time earned a reputation as inventor and as an authority upon plant life deserves more then a passing notice. It is the misfortune of most scientists to be so unpractical in their thoughts and habits as to cause comment and often ridicule. It is the misfortune of most inventors to be ignorant of Natural History and Physics. The Reverend gentleman alluded to was not only a scientists and an inventor but a clergyman and a teacher. As microscopists we feel deeply indebted to him for his published works relating to those obscure forms of vegetable life which excite our interest and curiosity, but we can appreciate also the work done by him in other and possibly more practical fields of labor.

The American Society Meeting.—Not being able to go to Madison, Wis., to attend the meeting this year, we were unprovided with reports until Professor Seaman came to our rescue and furnished some items. We are also indebted to the *Madison Democrat* for copy. We shall be glad to have authors who presented papers furnish us with abstracts for publication.

Carborundum.—This new compound is made from carbon, sand and salt, but it is composed of silicon 69 per cent, carbon 30, impurities 1 per cent. Under the microscope it exhibits crystals of a blue color, but with some of a yellow-green color, some black, and some white. Mr. Hagen has kindly favored us with some specimens of this new crystal.

To a limited number of subscribers we can mail enough to make a few mounts, and to all our contributors who so desire we shall take great pleasure in sending samples.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

169.—*Describe fully how to stain bacilli to show spores, flagellae and capsules.—Enquirer.*

Lœeffler's method is best for flagellæ. Take 2¾ drams of 20 per cent solution of tannin in water, add 1½ drams of a cold saturated solution of sulphate of iron and 16 drops a saturated solution of fuchsin, or of methyl blue, in water and mix well. Just before using, add 16 minims of a 1 per cent solution of sodium hydrate. This is the mordant.

The staining fluid is a saturated solution of fuchsin in aniline water. Add about 20 drops of a 1 per cent solution of sodium hydrate to 4 oz. of the stain.

The cover glass should be prepared from a pure culture because albuminous material will be stained also and obscure the delicate flagellæ. Pass the film lightly through a flame, flood with the mordant, heat until steam arises, and wash thoroughly. Flood with the stain and steam as before, let the stain act for one minute, wash thoroughly, dry, and mount in xylol balsam.

The above aniline-water fuchsin will stain capsules. The prepared cover must be carefully flamed as above, because the capsules are very easily destroyed. Prepared covers for spores should be rather strongly flamed. Spores are very resistant and are best seen when the bodies of the bacilli are partly destroyed. Too much flaming will destroy the bacilli so that after

staining the spores will appear isolated and their relation to the bacilli not easily recognized.

See the A. M. M. J. Vol. XIII, Page 3, for an excellent article by Dr V. A. Moore.

170.—*How can I stain sputum for the Pneumococcus, and material from the brain for bacteria in meningitis?—L.*

Make two fluids: an aniline-water-fuchsin as above, and saturated solution of methyl-blue in water. Prepare cover glasses by flaming. Stain in the fuchsin about one minute, then immerse in the methyl-blue about three minutes. Wash in water, dry and mount in xylol balsam.

171.—*Give the best method for staining anthrax bacilli in tissues, diphtheria and typhoid bacteria in tissues and on covers.—L.*

Take Methyl blue, 2 parts; alcohol, 15 parts; water 85 parts; and mix well. The sections should remain in this stain for 24 hours, then be very carefully decolored in weak acetic acid.

Too much bleaching will bleach the bacilli also. A certain pale blue tint will indicate that the tissue is well bleached and the bacilli practically untouched. Wash quickly in water, dehydrate in absolute alcohol, clear in oil of origanum and mount in xylol balsam.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON, CLEVELAND, OHIO.

Cuticle of Equisitum.—The cuticle of the Scouring Rush (*equisitum*) is a fine polarizing object. To mount, cut the stems into suitable sizes. Place the pieces in a test-tube half full of water, add a few drops of nitric acid and boil for a few minutes over a spirit lamp. The cuticle which is pure silex, separates from the vegetable portion and rises to the surface. Next, wash thorourghly so as to remove all traces of the acid. Then place the pieces between two slides and hold them together with a spring clip. Leave them in that position until they are dry and flattened; then remove and mount in balsam.

Crystals of Urine.—Urine is an exceedingly crystalizable substance and slides are very easily prepared for the polariscope. Let it settle in a conical glass from twelve to twenty-four hours. Take a portion of the sediment in a pipette and place it in the center of a slide. Cover the slide so as to

keep out dust, but do not use any cover-glass. In a short time (from one to two hours), the whole will be a mass of crystals. Let them dry in the air and then mount in benzole balsam. Most of these crystals are brilliant polariscopic objects but perhaps a few will not polarize. Triple phosphates do not settle but form a film on the surface; this film can be transferred to the slide with a spatula and be treated as above directed. The pathological significance of these crystals can be learned by consulting the plates of the numerous works devoted to medical microscopy.

Sections of Potato.—A very good and instructive section of potato can be made with a razor. Trim away the thick parts and place the thin section in the center of a slide. Flood with alcohol in order to dry the specimen. This flooding will wash out a great deal of the starch from the cells and leave other cells full. This washing increases the interest of the slide, as thereby you can contrast the empty cells with the others. When perfectly dry, mount in balsam and view by polarized light. It is an interesting specimen with ordinary light, but its beauty is enhanced a thousand fold by polarization. Do not stain the specimen. Beauty is, when unadorned, adorned the most. Staining will only destroy the natural beauty of the object.

How to Examine a Water Supply.—Tie a small bag over the spigot of a wash basin and let the water run until the bag gets like a sausage; then remove and empty it into a conical glass; and when it has settled, examine the contents. Always turn the bag wrong side out and wash it into the water you desire to examine. Some of the best specimens adhere closely to the cloth and even stick in its meshes. Any cloth of fine texture will answer. The little cloth sacks in which smoking tobacco is put up for sale will answer the purpose well. If the bag be too large, too thick, or too thin, it will not work well. The spigots over the sink in kitchens are too large and do not give satisfactory results. There are also a number specimens that habitually rise to the top and this top should always be examined. On the surface will be found some of the rarest specimens. First examine the top in a cell and with an inch objective. The examination of water is interesting at all times of the year.

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THE MICROSCOPE.

NOVEMBER, 1893.

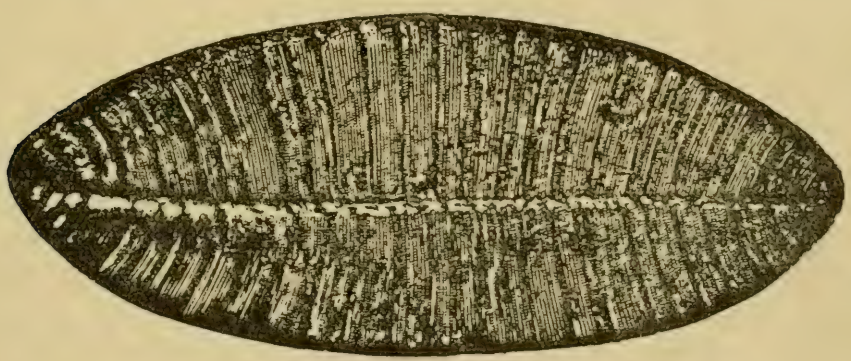
NUMBER 11. NEW SERIES.

OBJECTS SEEN UNDER THE MICROSCOPE.

III.—NATURE'S JEWELS (DIATOMS).

[PHOTO-MICROGRAPH.]

The Diatom here presented is the *Surirella gemma*. There are nearly 60 species of the genus *Surirella*. This is a marine form and measures about 1-240 of an inch in length. The cut shows an enlargement of 1200 times.



This photo-micrograph was made by Nachet of Paris by means of a 1-10 oil immersion objective, and the bringing out of the minute pearls is considered a great feat. They are shown somewhat better in his original than in this engraving. Nachet is perhaps the best maker of microscopes in France.

To those unfamiliar with diatoms, we may say that this very minute form is a plant, whose shell naturalists call a frustule. The soft parts, when present, more easily disappear leaving the frustule in sight. The illustration presents a side view of a frustule unaccompanied by any soft parts. A front view would be of quite different shape and an end view still more so but of less interest. This hollow frustule consists of two halves called

valves which fit together along the median line running from end to end (and which shows so conspicously), much as the cover fits upon a pill-box.

The cavity or resulting enclosure is of many different shapes in different species of diatoms and serves for the reproduction of the species. One of the valves is always older than the other and the hoop of the older valve partly encloses the younger. As growth progresses the outer hoop slides off the inner one until often there is but very little overlap.

The species is perpetuated and increased by each frustule dividing into two frustules and so multiplying its numbers indefinitely. After the death of each plant the frustules remain and may last for centuries if buried under favoring conditions, or otherwise preserved.

A METRIC STUDY OF TWO THOUSAND CHECK SIGNATURES.

By Dr. Marshall D. Ewell,

CHICAGO, ILL.

The various methods of committing forgery and the means available for its detection were discussed by the writer in the *American Law Register*, Vol. XXIX, 1890, p. 553. In that paper we stated that perfect identity of two signatures is very strong, if not conclusive, evidence of fraud, referring to the famous Howland will case, which will be found abstracted on p. 562 of the same volume.

A similar question arose in the case of the will of late Senator Joseph E. McDonald, recently tried at Nobleville, Indiana, in which the verdict was that the will was a forgery.

In the preparation of that case it was thought expedient to investigate the question of the length of signatures written in the ordinary course of business by the same person, with the view of ascertaining, if possible, the law, if any, governing the same. With that end in view the writer measured the length of 700 of his own checks drawn on the First National Bank of Chicago between the years 1884 and 1888, and also 300 checks drawn on the Merchants' Loan and Trust Company in the years 1891 and 1892. The former were drawn on smaller blanks than the lat-

ter, and hence will be separately discussed for reasons hereinafter stated.

Six hundred and twenty-six check signatures of Mr. Alpheus H. Snow, 133 of Mr. Parke Daniel, and several hundred checks signatures of other parties were also examined.

While making these measurments we also compared the checks of the same persons respectively *inter sese*, with the view of finding, if there were any, such as were exactly, or within very narrow limits, identical in size and form, but found not a single instance of such identity. We had not proceeded far in the investigation before it became apparent that the length of the signature depends to some extent upon the length of the line upon which it is written; and that even in cases where the line is longer than is necessary for the signature, as ordinarily written, it invariably affects the length of the signature; so that the average length of the signature diminishes with the length of the line upon which it is written. It is obvious, therefore, that there can be no settled mean length of signatures unless they are written upon lines of substantially the same length. By *lines* in this connection is not meant lines running entirely across the sheet of paper, but such lines of convenient length as are usually found upon blank checks and other similar documents. Having arrived at this conclusion, we endeavored to ascertain whether those signatures written on similar blank checks under substantially the same conditions were governed, as we suppose, by the general law of probability, so that the platted curves hereinafter described, would form what is known as the "probability curve."

The results arrived at were not conclusive upon this point, though we are of the opinion that, given a sufficiently large number of signatures written upon similar blanks and under the same conditions, they would be governed by the law above referred to.

The method adopted was as follows: The lengths of the separate signatures of each person were added together and the sum divided by the number of signatures, giving the mean length. The length of each separate signature was then subtracted from this mean length, giving a series of remainders *plus* and *minus*. These residuals were then classiffied and curves platted in which the ordinates represent the number of signa-

tures and the abscissas their residuals, plus and minus. The result of this labor, which was not inconsiderable, did not entirely realize our expectations, though in the scientific examination of any question even negative results are valuable.

The will of Mr. McDonald was alleged to have been executed in duplicate. A counterpart was originally propounded for probate: the other counterpart was a carbon copy of the first. The signatures to the two counterparts were substantially identical. No cut could disclose this identity as satisfactorily as an inspection of the originals.

The following conclusions seem warranted by the facts:

(1) The two signatures of the alleged testator, Joseph E McDonald, and the alleged subscribing witness, Parke Daniels, are so nearly identical as to warrant the conclusion that the will is a forgery.

(2) The length of the signatures of the same person depends to some extent upon the length of the lines upon which they are written, increasing and decreasing with the same, even when such lines are ample in length for the ordinary signature of the writer.

(3) No satisfactory conclusion can be predicated as to the length of a signature under ordinary conditions as they occur in practice, unless a large number of genuine signatures is available, and then only when the disputed signature falls considerably beyond the limits established by such signatures.

KENT LAW SCHOOL, CHICAGO, ILL.

AN AQUEOUS SOLUTION OF HEMATOXYLIN WHICH DOES NOT READILY DETERIORATE.

By SIMON HENRY GAGE,

ITHACA, N. Y.

[From Proceedings of the American Microscopical Society.]

For most of the purposes of histology there is a no more satisfactory and generally applicable stain than hematoxylin, and experience has shown that aqueous solutions are on the whole preferable to those containing a considerable quantity of alcohol. Every microscopist knows, however, that aqueous solutions of hematoxylin soon begin to deposit a dark precipitate on the

bottle and become filled with granules and frequently with threads.

As so many changes are due to living ferments (organized ferments, as bacteria, yeast-like fungi, etc.), it occurred to the writer that the deterioration of the hematoxylin might be due, wholly or in part, to one or more of these organized ferments. If this supposition is correct, any ferments accidentally present in the water and alum used, should be destroyed. If then some substance is added to the solution to prevent the development of germs that might subsequently get into the solution, the solution would be likely to be lasting and to retain its excellence. Experiments proved the accuracy of the hypothesis. An aqueous solution of hematoxylin prepared as directed below and made nearly a year previous to the present writing is still in excellent condition. During the year it has been in the laboratory and subjected to all the vicissitudes of heat, dust, light, and all the other conditions that an ordinary histological re-agent must endure. It has remained in the same bottle all the time, and now, after nearly a year, there is no deposit on the bottle, and the stain acts as well as in the beginning.

Formula:

Distilled water	200 cc.
Potash or ammonia alum	7½ grams.
Chloral hydrate	4 grams.
Hematoxylin crystals	1-10 gram.

To prepare the solution, place the water and alum in an agate or porcelain vessel and boil for five minutes or more, preferably fifteen or twenty minutes if the water is not freshly distilled. This boiling will destroy any germs in the water or alum. Allow the boiled alum solution to cool, and add sufficient freshly boiled distilled water to compensate for evaporation and make 200 cc. of alum water. Add the chloral hydrate and dissolve the hematoxylin crystals in 10 cc. of 95 per cent alcohol and add to the mixture.

At first the color will be rather faint, but after a week or two it will become a deep purple. The deepening of the color is more rapid if the bottle is left uncorked in the light and is shaken occasionally.

If the stain is too concentrated it may be diluted with freshly distilled water or with a mixture of water, alum, and chloral.

If the stain is not sufficiently concentrated more hematoxylin may be added. With hematoxylin of the strength given in the formula, sections are usually sufficiently stained in from one to five minutes.

As may be inferred from what was said above, the boiling is to destroy any living ferments present in the water or alum, and the chloral hydrate is to prevent the development of germs which accidentally reach the solution after it is made.

No precaution is necessary in using this stain for sections, except that applicable to all hematoxylin solutions, viz: after staining, the surplus stain must be very thoroughly washed away with distilled water; otherwise black granules or needles will appear in or upon the sections. If granules appear in the preparations in spite of the washing, it will be well to boil the solution three to five minutes and filter through paper or absorbent cotton. The addition of one or two per cent of chloral after the boiling is also advantageous. This stain has not been tried for dyeing in bulk. Other substances than chloral were tried, but not with so good success. For stains other than hematoxylin, chloral might not prove so satisfactory a preservative.

As hematoxylin is for most tissues, almost a pure nuclear dye, it has been found advantageous to stain the cell body, ground substance, etc., with a general or counter stain. One of the most satisfactory of these is eosin, prepared as follows:

Distilled water	50 cc.
95 per cent alcohol	50 cc.
Dry eosin	1–10 gram.

The eosin is used after the hematoxylin in most cases, and, as it is in alcoholic solution, it may be washed off with 95 per cent alcohol if the object is to be mounted in balsam. If it is to be mounted in glycerin or glycerin jelly, the excess of eosin should be washed away with distilled water.

An excellent counter-stain for many objects is picric acid. One proceeds with this as with the eosin, except that a saturated alcoholic solution is made and after the hematoxylin is washed away a drop of the picric acid solution is added. This is then washed away with 95 per cent alcohol. The time required for the eosin or the picric acid to stain is very short, usually only a few seconds.

SECTIONING FERN PROTHALLIA AND OTHER DELICATE OBJECTS.

By M. B. THOMAS,

CRAWFORDSVILLE, IND.

The material to be sectioned is first hardened by placing it in 10 per cent alcohol in a dehydrating apparatus and allowing it to remain for 24 hours. It is then taken out and placed for 1 hour in 95 per cent alcohol to insure complete dehydration after hardening. After this the tissue is placed in a 1½ per cent solution of collodion and allowed to remain in a tightly corked vial for 12 hours. (The collodion is best made by dissolving 1½ grams of gun cotton in 100 c. c. of equal parts ether and alcohol.)

The cork is then removed and by slow evaporation of the ether and alcohol the collodion will thicken. When it is of the consistency of ordinary glue the tissue is taken out and placed in a paper boat, of the kind used in paraffine imbedding, or an ordinary watch glass will answer the purpose. The thick collodion is then poured over the tissue and it is allowed to harden in the air until a firm film is formed over the surface.

It is better to pour out the tissue from the vial with the collodion and thus prevent it from being broken by handling.

After the firm film is formed the dish is placed in a jar of 85 per cent alcohol and allowed to remain from 5 to 6 hours until the collodion is quite firm. Then with a thin knife cut out a block of the collodion containing the tissue inside.

The block can be placed in any desired position on the end of a cork and held while thick collodion is poured over it until enough is applied to completely cover it. Each coat as added should be allowed to slightly harden before applying the next until the operation is completed.

After this is accomplished and the whole allowed to partially solidify in the air, the material is placed in a jar of 85 per cent alcohol where it should remain to harden 6 to 8 hours.

The cork can be fastened in the jaws of any sliding microtome and serial sections of any desired thickness made in the usual way.

The knife should be kept wet with alcohol during the operation, and the sections removed from the knife to the slide by means of camel's hair brush.

After the sections are arranged they can be fastened to the slide by blowing over them ether vapor or by placing a few drops of ether on the slide and allowing it to spread until the collodion is melted.

After the sections are fastened they can be stained, cleared and mounted in the usual way.

In order that the sections may be all arranged the same side up, the block of collodion, which should always be trimmed at the top, can be cut with a notch near one corner and the notches all arranged with the same relative position on the slide.

It will be found that with this method, perfect serial sections of any desired thickness can be obtained from objects which are not more than one layer of cells thick, and thus render the preparation of delicate tissues but little more difficult than that of the firmer kinds found in ordinary stems or roots.

WABASH COLLEGE, *Octo.* 25, 1893.

Society of American Botanists.—The botanists are at present much more active in organizing than the zoologists. They were not satisfied with having a Botanical Club in connection with the American Association for Advancement of Science, but they demanded a separate section for botany. They had previously read their papers in the Biological section. Now they are organizing a National society. The Botanical Club at Madison, Wis., Aug. 23, 1893, appointed a committee of ten which was to select enough other persons to make a nucleus of 25. These 25 are to become the charter members of the National Society. A committee on organization, headed by Prof. Wm. Trelease of St. Louis is preparing a constitution and will report next August when the 25 charter members are expected to gather at the A. A. A. S. It is understood that the membership will be limited to persons who have attained considerable prominence in botany. In the list of charter members, we notice a good many names of subscribers to the microscopical literature of the day. A cryptogamous botanist must of necessity be a microscopist.

Pasteur's Fluid is made in the proportion:—

Water 4150 parts; cane sugar, 750 parts; ammonium tartrate, 50 parts; potassium phosphate, 10 parts; calcium phosphate, 1 part; magnesium sulphate, 1 part.

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

W. WATSON & SONS' CATALOGUES OF MICROSCOPES AND MICROSCOPIC OBJECTS.

In the Microscope Catalogue just issued, we notice more space given to the Van Heurck Microscope which seems to gain an increasing amount of favor and is already used by many of the most renound workers. The makers have devised a new form of rackwork draw-tube at a very low price specially for the Edinburgh Student's Microscope, and have adapted the tripod foot to this stand. Buyers can choose between this and the horse-shoe. On page 44 will be noticed particulars of Mr. Nelson's new semi-mechanical Stage as described by him at the Royal Microscopical Society's meeting in March last. We have also observed a new series of Aplanatic Magnifiers having powers to 6, 10, and 20 diameters. They give a large and flat field combined with good working distance, and are especially intended for dissecting purposes. The Laboratory Dissecting Microscope, page 57, being provided with a fitting to receive the same.

Messrs Watson have not been able, so far, to use aluminum in the construction of microscopes to any extent, but in the various pieces of apparatus have found it useful and now mount the Abbe Illuminators and the Achromatic Condenser quoted on pages 62 and 63 in that metal. Owing to the size of the Lens they are of necessity somewhat clumsy, and the aluminum affords a very considerable reduction in weight. They also

make the Abbe Model Camera Lucidas, resolving Nosepieces, and a reversible Compressor in aluminum.

In the Object Catalogue they have considerably extended the list of Bacteriological Specimens, and are now able to offer medical men and Health officers very complete sets of Specimens comprising all the principal subjects that are required by students in England for the "Diploma of Public Health." They have also revised their Botanical preparations so that in every case the best example to illustrate a particular structure may be given. Various new, popular, and show slides are also included.

This house has just received three awards at the World's Fair, Chicago, being the highest conferred on any firm of opticians, and making a total of 36 gold and other medals that have been awarded to them at International Exhibitions.

A New Book on Diatoms Proposed.—By request of the author, Dr. A. M. Edwards, we invite subscriptions to Bacillariæ. It will contain a popular account of Diatoms in general and the mode of collecting and cleaning their shells. Illustrated, 100 pp. Price $3. Club rates to our subscribers $2.75. From this price a further allowance of 25 cents will be made to those who subscribe during November, payment to be made on publication of the volume.

Mosquitos.—There is no longer excuse for these pests existing as it has been found that a little kerosene oil poured upon a pond's surface when they are germinating will destroy millions of them. Perhaps a few should be saved for mounting as microscopical specimens. We do not want to actually exterminate them.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

172. *What is the theory and practice in the use of a mordant in bacteriology? Is it to fix the tissues or what is it for?—Enquirer.*

Some mordants act by penetrating the substance of the bacteria and assisting the entrance of the dye; and so produce a very intense staining which will resist the subsequent washings, etc. Others act by saturating the bacteria and producing therein a difficulty soluble precipitate with the dye.

173. *Is there a difference between homogeneous and oil immersion objectives? Can prepared cedar oil be used with a homogeneous immersion objective?—Enquirer.*

It is always best to use the immersion fluid recommended by the maker of the objective; but, as cedar oil and homogeneous immersion fluid are usually prepared so as to have the same refractive index as the front lens of the objective (optical glass), either fluid may be used, as a rule.

174. *Is aniline water the same thing as aniline oil? If not, how is aniline water prepared?—Enquirer.*

Three drops of aniline oil to a dram of water, well shaken together and filtered, is called aniline water. A solution of a dye in aniline water will keep good about one week.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

Collar Correction of Objectives.—The usual instruction given to a novice for the correction of his adjustable objective is to turn the collar until a clear and distinct image is obtained This is vague, indefinite, and misleading, because it is almost impossible to know when a perfecty clear and distinct image of an unknown object has been obtained. A more certain, correct, and scientific test is by color. If noticed carefully, all objectives show some of the colors of the spectrum in the specimens viewed and this can be taken advantage of for the correction of the lens. The following table will solve the problem:

CENTRAL LIGHT.

When under-corrected—elevations red.
When under-corrected—depressions green.
When just right—elevations light violet.
When just right—depressions green pippin.

The above is given for immersion lenses and varies slightly with dry lenses.

Ring-worm.—I have rarely spent a more instructive and pleasurable evening with the 'scope than I did a few evenings ago when I was fortunate enough to view five different kinds of fungi. A young lady called with a ring-worm on her arm and was filled with fear of blood disease. With a spatula a little of the "worm" was scraped off placed in the center of the slide, flooded with potassium hydrate, covered and examined with a quarter inch objective when the characteristic mycelium of *Achorion schoelinii* appeared. This is pictured on page 52 of "Microbes and Ferments," Vol. LVI, of the International Scientific series. The young lady bound the spot with cotton soaked in sulphurous acid and in a few days all traces were removed.

Grape-mould.—My next specimen was a grape containing felt-like mould. Scraping off a small portion and placing it on a slide with the potassium hydrate, I had the extreme pleasure of seeing the beautiful fungus *Uncinula spiralis*, a troublesome disease of grapes. This is described and elegantly figured in the report of the U. S. Department of Agriculture for 1886, page 105, plate 2. It was a sight worth seeing and was obtained by simply scraping some grapes purchased for the table.

Ragweed.—I then took some leaves of ragweed. They were growing around the sides and under the eaves of a country town-hall. A layman claimed that the paint from the building had washed off and covered the leaves. A Coddington lens showed the little spots or conceptacles dotting the white-washed leaves. I gathered a large supply, but placed them between the leaves of a book. Arriving home, I examined first with a one inch objective as an opaque object, and then examined them as already described in the August "Microscope" p. 126, under directions for mounting *Erysiphe*. This fungus was very interesting but I found it almost buried beneath several Greek and Latin names. Dr. M. C. Cooke in his little work on "Microscopic Fungi" figures it in plate XII, figure 249, and calls it *Erysiphe linkii*. Ellis & Everhardt in their great work on American Pyronomycetes on page 12 call it *E. cichoracearum* and also mention the synonyms under which it is known.

Tomato Fungus—Black Rot.—My next specimen was a tomato sunken so that half of the globe remained and the sunken surface was covered with a black powder. As usual with fungi, I examined the black powder in potassium hydrate with a quarter inch objective and found some rare fungus. For want of sufficient library on the subject I feared that I would be unable to answer the question oft put to the microscopists: "What is it?" But I chanced to remember that I had seen a picture similar to my tomato in one of the U. S. Agriculture reports and I soon found it in the report of 1883 described on page 339 as the black rot of the tomato and figured in a colored plate, as *Macrosporium solani*. The spores were quite dry and I mounted them in benzole balsam without any previous preparation.

White Rust.—My last specimen was a small piece of tomato some one had sent me in a small bottle. Taking a small particle, I pressed it down with a cover, examined with a quarter inch and saw the conidia of white rust, *Cystopus candidus* just as the same is figured in plate X, figure 200, of "Microscopic Fungi" by Dr. M. C. Cooke.

SCIENCE-GOSSIP.

Milk— is probably the worst medium of infection in tuberculosis and several other bacterial diseases.

Pixol— is a new disinfectant but it has failed as regards cholera. It is a solution of tar in which the comma bacillus has been exposed 16 hours without effect. Boiling is the surest method of disinfecting.

Flagella.—The character of the flagella on several kinds of bacilli has been investigated by Dr. V. A. Moore and published in a volume called "The Wilder Quarter-Century Book." Those interested in the subject should write to him for a copy. His address: Washington, D. C.

Our Own Birds— is the title of a book just issued by Lippincott and it is of use in identifying the common birds.

Botany.--Botany need no longer be taught as of old—merely for identifying species. Vegetable physiology should take the first place in the student's thoughts. The teacher can give the names of the plants studied and let the student use his microscope upon the bacteria, the smuts, the mildews, and rusts.

Vienna— is to have a Pasteur Institute in connection with one of its large hospitals.

Banknotes—carry microbes. On a note that had circulated some time 19,000 microbes were found, including the bacilli of tuberculosis and of diphtheria and the streptococcus of erysipelas.

The GWA Mixture.—This is an abbreviation for glycerine (1 part,) water (2 parts,) alcohol (3 parts,) and is sometimes called the 1-2-3 mixture. It is used for soaking vegetable sections before mounting them in Farrant's medium.

Triassic Diatomaceæ.—Dr. A. M. Edwards reports (*Am. Nat., Sept.* 1893), finding diatoms in a clay pit near Passaic, N. J., which he considers to be the first ever found in that geological formation. This Triassic clay contained *Gomphonema acuminatum* and *Brebissonia lanceolata* associated with sponge spicules.

Deane's Medium.—Soak one oz. gelatine in 4 oz. of water until the gelatine becomes soft, add 5 oz. of honey heated to a boiling point, boil the mixture, then cool (but not stiff) add ½ oz. of rectified spirit and 5 drops of creosote. Filter through fine flannel.

RECENT PUBLICATIONS.

Text-Book of Normal Histology. By Geo. A. Piersol, M. D. 8°. 439 pp. 300 illustrations. $3.50. Phila. 1893. J. B. Lippincott Company.

In the preparation of the text, the author has supplied descriptions of the various tissues and organs; these, while at once clear and brief, nevertheless avoid too great conciseness, which, where fact follows fact in rapid succession, proves bewildering to the student; at the same time, the subjects are considered with sufficient completeness to assure an adequate presentation of important details. The systematic arrangement adopted brings the most essential matter into prominence so that it may be selected and assimilated readily by the student.

The paragraphs devoted to histogenesis will be found additions of value as pointing out the fundamental relations existing between many tissues and organs, and as emphasizing the

broader morphological basis upon which structural anatomy at present rests. An appendix devoted to microscopical technology supplies detailed instructions concerning the important methods of work, a mastery of which is essential for every one proposing to undertake histological investigation; the author's extended and varied experience renders his suggestions often of especial value.

The illustrations of the book will be found particularly interesting, since the author has accomplished the no inconsiderable task of preparing new and original drawings for the entire field of normal histology. With few exceptions the drawings are based upon camera lucida sketches or photo-micrographs, and as far as possible represent human tissues; while retaining sufficient diagrammatic clearness to render them thoroughly efficient as aids in comprehending the descriptions of the text, they are faithful likenesses of the actual structures.

The Psychic Factors of Civilization. By Lester F. Ward. Boston. Ginn & Company, 1893. 8vo. Cloth, 369 pages. By mail, postpaid, $2.00.

This work, like its predecessor, Dynamic Sociology, makes a bold advance into philosophy. It is not too much to say that it deals with the most important questions before the world and brings out some startling results. It shows that, notwithstanding the amount of attention that has been devoted to mind, the leading truths connected with its origin and development have been overlooked. It also shows that the true influence of mind in human history and civilization is little understood, and that its existence as a factor in political economy and social science has been deliberately ignored. The object of the book is to prepare the way for *a social science based on mind*, and to foreshadow a new political economy that shall recognize man as a rational being. In a word, it is a powerful protest against the sterile philosophy and dismal economics that have so long prevailed, and is itself a philosophy of hope based on faith in the efficacy of rational scientific action.

The work is embelished with a fine array of quotations, mottoes, and literary gems, so that it is almost an anthology of the subject. It is also provided with an annotated list of authors and titles, and a copious index.

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DECEMBER, 1893.

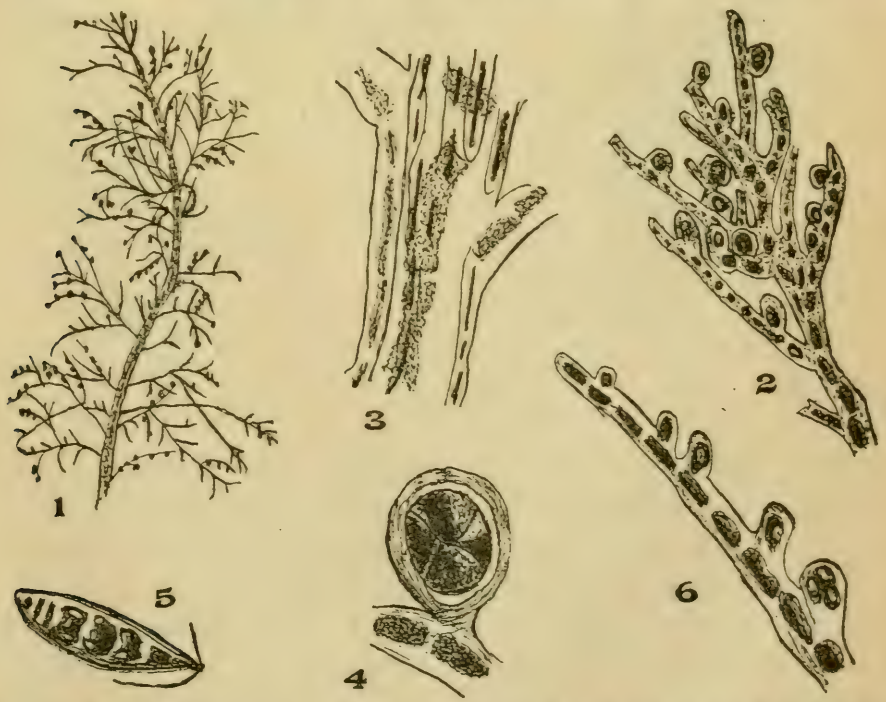
NUMBER 12. NEW SERIES.

OBJECTS SEEN UNDER THE MICROSCOPE.

IV.—ONE OF THE RED SEA-WEEDS.

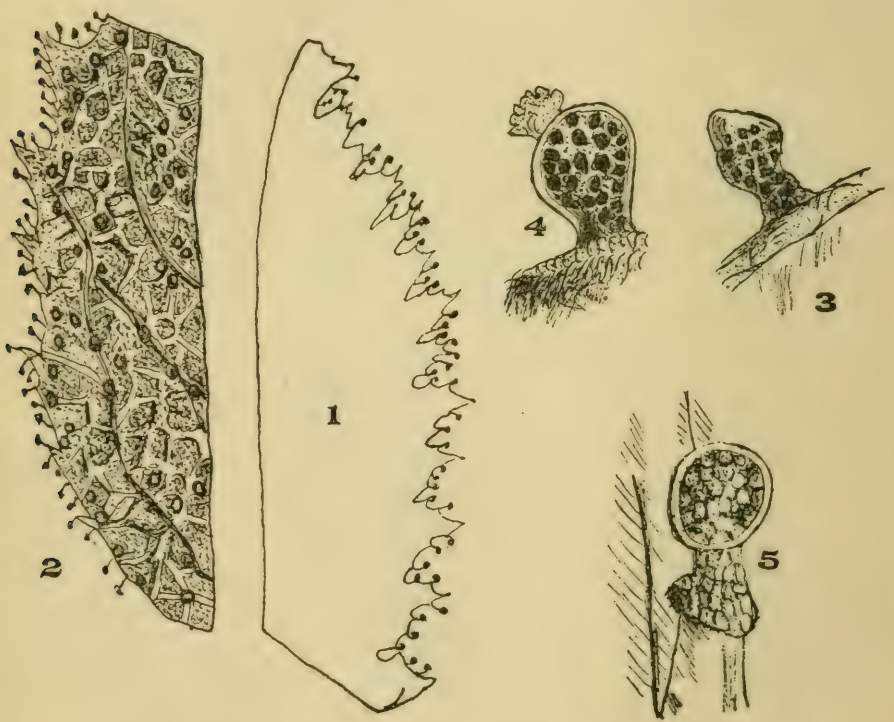
[PEN DRAWINGS.]

In Figure 1, you have a view of this delicate object magnified only ten diameters. It is known to naturalists as *Callithamnion roseum* and we are indebted to the late Tuffen West for the illustrations which we have redrawn from the International



Journal of Microscopy. (This Journal, which is published in England at $2.75 per year, we can supply to our subscribers at a very low price). In Figure 2, you can see one of the little branches magnified 50 diameters. Figure 3 shows a portion of

the main stem magnified 100 diameters. The round bodies on Figure 2 are called favellæ (honeycombs) and consist of groups of spores covered with a thin gellatinous membrane. One of them, enlarged to 200 diameters may be seen in Figure 4, in which appear the four spores (hence called "tetraspore"). Figure 5 is a spore receptacle called a "ceramidium." Figure 6 shows how fruit sometimes originates from a special modification of stunted branches. These spores are believed by some to be non-sexual and to need no fertilizing. If they thus grow to be plants without the aid of any sexual organs, they illustrate one

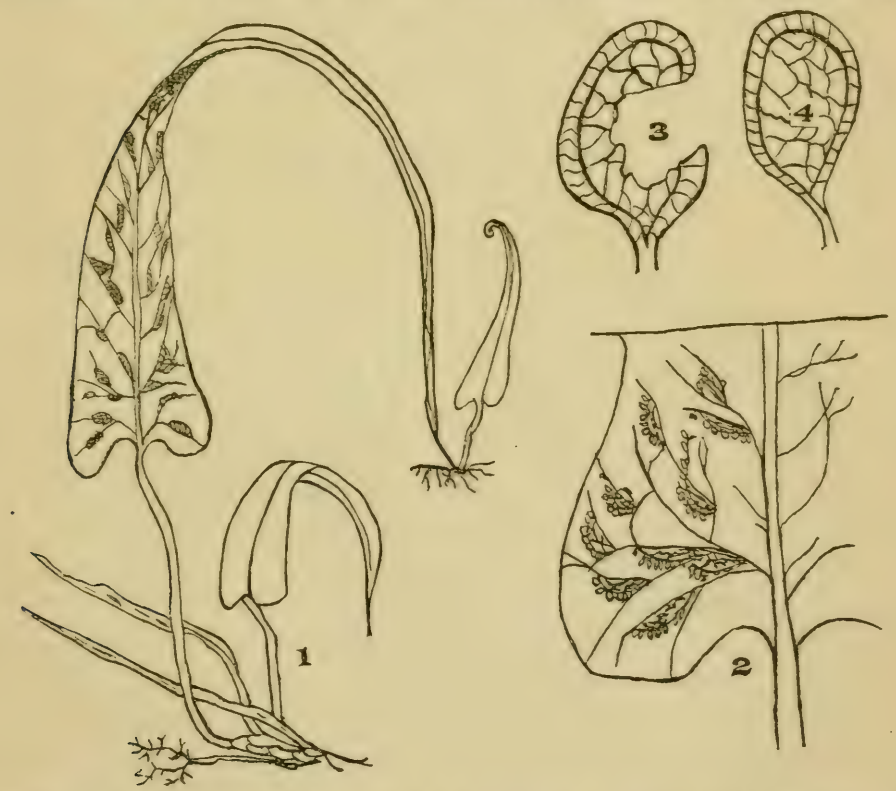


of the lowest forms of vegetable life. Of much interest also is this metamorphosis of branches into fruit-bearing organs—a very unnatural procedure, we should say. Two forms of fruit are produced by these two different means.

These sea-weeds grow in deeper water than other sea-weeds and often they exhibit the richest of tints. They should be looked for by every one who has access to the sea coast. The red color is due to a pigment and it has sometimes been separated out in the form of beautiful regular Crystals. For further information, see Carpenter, pp. 559-561.

V.—GLANDULAR HAIRS ON SWEET BRIAR LEAF.

Figure 1 shows a portion of the upper surface of a Sweet Briar Leaf magnified only 5 diameters. This surface does not have any glandular hairs but they may be seen projecting from the edge. Figure 2 shows the lower surface of the leaf which posseses more or less of the glandular hairs. The hairs themselves highly magnified, are shown in figures 3, 4, and 5. The tip on figure 4 is a little cap of Otto of Rose. By careful manipulation under the microscope, the cap is sometimes dislodged and then shows the semi-crystalline appearance of



Otto (or Attar of Rose),—the fragrant essential oil. Figure 5 represents the nearly colorless hairs. The interior of these ovals is filled with a soft cellular tissue.

VI.—THE WALKING FERN.

We are indebted to Mr. Fred R. Stearns of the American Magazine of Natural Science for all our information about this form which does not seem to be mentioned in any of the prominent botanies. He says that it grows in the shaded woodlands of Iowa. Figure 1 illustrates the parent plant (*Camptosorus*

rhizophyllus) whose frond, bending over to the ground, has given root to a new plant. The new plant may produce a long frond which in its turn will root a third plant. Mr. Stearns has seen three steps taken in one season, though generally one is sufficient.

Besides propagating in this manner, this fern propagates in the usual way, by means of spores. A section of leaf bearing spores is shown in figure 2, a closed spore case (sporangium) in figure 4, and a sporangium opened in order to discharge its spores in figure 3, these being magnified 400 diameters.

This peculiar "walking" method of producing new plants reminds us of the Banyan tree of India.

LIGHTING A MICROSCOPE WITH THE INCANDESCENT LAMP.

By JOSEPH HOGBOTHAM,

LONDON, ENGLAND.

At a recent microscopical exhibition, it was amusing to notice among the great variety of illuminating apparatus including oil lamps of all kinds, gas burners, etc, one instrument apparently without any light. On closer examination, however, it was found that a small incandescent lamp was concealed near the stage in such a manner as to give no light except upon the object. The object was beautifully illuminated. The arrangement is described in *The Optician* as follow:

The lamp was situated in the focus of a small silvered parabolic reflector whose wide end was covered by a blackened brass plate having a short brass tube screwed into it. This part of the apparatus looked like a swab used by gunners for cleaning out the bore of a cannon after a shot has been fired. Inserted into the small tube was a solid rod of clear glass having both ends ground perfectly plane, polished and at right angles to the axis of the glass rod. This rod may be inserted loosely or it may be soldered to the tube. It was blackened on the outside with Brunswick black or some dark japan, so that there was absolutely no light visible along the rod other than that which was projected from the end farther away from the light. The whole apparatus was so adjusted that this beam of light

was directed immediately below the object on the slide, thus avoiding all stray rays. A very small plano convex lens cemented to the end of the rod by means of Canada balsam served the purpose of concentrating the entire beam upon the object under examination. The great facility with which this was done showed that the apparatus was equal to, if not superior, to the Abbe condenser system.

There was sufficient illumination for the manipulation of the objects, and the great comfort obtained by the use of this so-called "dark lantern" more than paid for the cost of operating which was slight. This arrangement rendered the use of the eye shade, a device which is often used by the amateur microscopist, entirely unnecessary, another point in its favor.

The total refraction of the rays of light made it possible to have these light-conducting cylindrical glass rods of almost any shape. A bend may be made without any difficulty, and there can be little doubt but that they may be used as scale illuminators in well constructed electrical instruments.

The heat arising from the enclosing of the incandescent lamp in the reflector may be done away with by drilling several holes at the top and bottom of the encasing metal. A draught will thus be produced which will cool the heated interior. This heating is sometimes so intense that in one particular instance, where a green glass incandescent lamp was used in a parabolic reflector, some of the reflected rays were caught, by the green glass and absorbed, and in a comparatively short time the globe was softened, thus causing it to collapse.

The portion of the glass rod to be soldered to the brass tube should be prepared as follows: Coat it evenly with a dilute solution of platinic chloride, and deposit the metallic platinum by dipping into an essential oil, such as lavender. A bright grayish conduction film is thus obtained, which may be electroplated in a sulphate of copper bath. If an even and pliable coating is obtained, it may then be treated as an independent close-fitting tube, and may be soldered accordingly. Care should be taken, however, not to heat it too much in the act of soldering, for unequal expansion is liable to cause either a fracture or a loosening of the copper coating. If this should happen the glass rod may be cemented into the tube with some material, such as plaster of Paris, which is not affected by heat.

COLLECTING ALGÆ AND DESMIDS.

By Dr. ALFRED C. STOKES,
TRENTON, N.J.

[From Introduction to Keys to Fresh-Water Algæ.]

Algæ and Desmids are singly invisible to the naked eye. It is only when they occur in large masses that the eye can take cognizance of them. It rarely occurs, however, that the Desmids are so abundantly congregated that they thus obtrude themselves on the observer. When a large quantity has been collected and the vessel placed near a window, they will collect in a green film at the surface of the water on the lighted side, and there become visible in mass. In the ponds and shallows such an occurence is not common. At times they are found so abundantly that by holding a glass vessel of the water up to the light they may be seen floating about as minute green objects, which the trained eye will recognize and the pocket lens make distinct. But these varieties are among the largest of the forms; according to my experience they are always exclusively confined to the Closteriums. Other large forms, like *Micrasterias*, at least in the writer's locality, rarely occur in such profusion. To collect the Desmids, therefore, it is necessary to collect by faith. The microscopist can know exactly what he has only when he gets home and examines the water drop by drop under the microscope.

With the Algæ it is different. These are usually visible to the naked eye, as they are almost invariably collected in large masses floating on the surface, submerged just beneath the surface, or attached in waving tufts or fringes to sticks and stones and other plants in the ponds. The eye of faith is not needed to recognize them. They usually force themselves on the wondering attention of the observing pedestrian in the wayside lanes, beside the ditches and slow brooks. As soft emerald clouds, or graceful streamers floating in the sluggish current, or resting like a green scum on the surface, they are readily seen and as easily gathered. No collecting tools are demanded for either Algæ or Desmids, except a dipper of some kind, a common tin dipper is as good as anythig, and a few bottles or other vessels to carry the treasures home, and to keep them concealed from inquisitive people; the collecting naturalist must always be prepared for a meeting with such persons.

GENERAL DIRECTIONS FOR MICROSCOPIC WORK.

By PROF. E. S. BASTIAN,

CHICAGO, ILL.

[From his College Botany, pp. 218-9.]

1. Acquaint yourself thoroughly with the mechanism of the microscope you are to use.

2. Observe great care in the removing and putting on of objectives, so as not to drop them, for they are delicately constructed and liable to injury. The eye-pieces and eye-piece micrometer should also be handled with care.

3. Observe care in focussing, particularly when high powers are used, so as not to run the objective down against the slide and endanger either the cover-glass or the objective itself. Be sure also that you focus the microscope accurately, otherwise the structure of the object will not be distinctly seen.

4. Give due attention to the adjustment of the reflecting mirror, so as to secure the most favorable illumination of the object. Much of your success in seeing fine details of structure will depend upon the care exercised in this respect.

5. Bear in mind that many of the reagents used are corrosive and hence should not be brought into contact with the microscope. All the acids and iodine reagents will act upon brass work, potassium hydrate will corrode glass, and alcohol will remove the lacquering from the stand.

6. All objects examined in liquids should be covered, not only to obviate the danger of injuring the objective, but to avoid the inevitable distortion of the image which a curved or uneven liquid surface produces.

7. Let cleanliness and care characterize all your work in the microscopical laboratory. Keep all your apparatus, slides, cover glasses, etc., scrupulously clean. Do not touch the glasses of the objectives or eye-pieces with your fingers, for that would be to soil them and impair their optical performance. Whenever they need cleansing, breathe upon the glasses and wipe them either with a piece of perfectly clean and soft linen cloth, or with a piece of the thin, soft paper that is sold at dental supply-stores under the name of Japanese filter paper. A convenient way is to keep always at hand, in a place secure from dust, a quantity of this paper cut into suitable sizes. It is useful, also,

for cleaning cover-glasses, slides, etc. If a fresh piece is used each time for cleaning an objective, there will be little danger of marring the polish of the front lens.

Keep the bottles containing reagents, staining fluids, etc., stopped when not in use, so as to exclude dust and prevent evaporation; and take especial care in using them not to introduce impurities into them.

8. In cutting sections, the razor or section-knife should always be very sharp, and for most purposes sections should be cut quite thin. Steadiness in cutting is secured by resting the wrists against the body. The knife should be given an oblique or sliding motion when drawn through the object. Quite hard tissues may be successfully cut if the sections are cut quite thin, but if the edge of the knife is allowed to run too deep, it is liable to be notched. Portions of thin structures like leaves, petals, etc., may readily be sectioned by placing them between pieces of Elder or Sunflower pith. Always clean the knife after cutting with it, and do not allow fragments of tissue to dry upon it. Sections of fresh tissues, or of those that have been preserved in any of the preservative fluids, should immediately be placed in liquid after cutting, to prevent air from getting into the cells.

9. In all your work with the microscope, proceed understandingly. Endeavor to know the reason for every test you are called upon to apply, and be careful in interpreting the results of each test. Do not rest satisfied until you thoroughly understand every tissue and structure given you for study.

10. It is excellent practice for the student to keep an accurate record in writing, and by means of drawings, of all the facts observed and the work done by him in the microscopical laboratory.

Flies and Contagion.—A fly was infected with cholera and allowed to feed upon some beef. The meat was in due time found swarming with the bacteria. If Cholera ever gets a start in Washington it will run riot, for there are, every summer, in this city more flies to each acre than can be found in all Paris. Only those who screen the flies out of their houses may expect to escape and even then contagion may come in on meat and other eatables. Sufficient heat, however, will sterilize the food,

THE MICROSCOPE.

New Series, 1893.

For Naturalists, Physicians, and Druggists, and Designed to Popularize Microscopy.

Published monthly. Price $1.00 per annum. Subscriptions should end with the year. The old series, consisting of 12 volumes (1881–1892), ended with December, 1892. Sets of the old series cannot be furnished. All correspondence, exchanges, and books for notice should be addressed to the Microscopical Publishing Co., Washington, D. C., U. S. A.

CHARLES W. SMILEY, A. M., EDITOR.

EDITORIAL.

Sterilizing Milk.—Milk should be sterilized at the earliest possible moment and milk-sterilizing depots should be established for the purpose. A reform is needed also in milking, cleaning stables and cows, and in handling of milk. To-day, milk is a dangerous medium for transmitting disease germs.

An epidemic of diphtheria has recently occurred in Hightstown, N. J., supposed to be due to infected milk. All the cases were upon one milk route, the town being divided into six different routes. In one family the parents drank the suspected milk and had the disease. The children, who were fed from a different source escaped. As soon as the suspected milk was prohibited the epidemic ceased. The milk was infected by the milk boy who had had a mild form of diphtheria for ten days before and continued at work with these germs about him. Boards of Health are more and more learning to look to the milk for explanation of epidemics, and careful people are learning to be very cautious about their milk supply.

Study of Mosses.—An illustrated guide to British Mosses with 59 plates has just been issued by Rev. H. G. Jameson. Its great merit is in enabling anyone to identify mosses almost at sight by reason of the careful key and the accurate pictures. The book describes the structure of mosses, the apparatus needed

for their study and fits one for a happy time over the mosses.

We hope some one will prepare a similar book on American mosses.

Microbes on Postal Cards.—Bacilli have been found alive after 20 hours existence on a postal card. A letter was infected by cholera bacilli, put into the mail; when taken out 24 hours later the bacilli were alive.

Microscopes for Druggist.—The number of Druggists who own and can use a microscope is rapidly increasing owing to the adulteration of drugs and other causes. The instrument is being used in the colleges of pharmacy and state associations begin to have sections of microscopy.

QUESTIONS ANSWERED.

NOTE.—*Dr. S. G. Shanks, of Albany, N. Y., kindly consents to receive all sorts of questions relating to microscopy, whether asked by professionals or amateurs. Persons of all grades of experience, from the beginner upward, are welcome to the benefits of this department. The questions are numbered for future reference.*

175. *What is an aplanatic system eye-piece?—S.*

An aplanatic eye-piece is usually one of the achromatic forms (such as the Priscopic), in which spherical aberration is, as nearly as possible, eliminated. Any eye-piece presenting a flat field with no peripheral distortion is aplanatic.

176. *What is the highest power objective yet made?—S.*

The 1-75 inch objective made by the late R. B. Tolles, of Boston, in 1878, and owned by Dr Ephraim Cutter of New York, is probably the highest power objective yet made for actual work.

177. *What is Heliomicroscopy?—S.*

Heliomicroscopy means the use of direct sunlight for illuminating the object, either for critical resolution or for the projection of the image on a screen.

178. *I have 30 mounted diatoms and wish to classify and name them. What books do I need for the purpose?*

The Am. Mo. Mic. Journal, Vol. xii, (1890), contains a series of papers on the life history and classification of diatoms.

179. *Are the prices quoted in the advertisement of Watson & Sons, in the Microscope, the prices in the United States duty paid?—G. H. G.*

No. They are the prices in London, the purchaser to pay freight and duty.

180. *I have a ¼ inch objective and desire a higher power for the study of vegetable histology. Would a 1-7 inch, or ⅛ inch, dry objective, student grade, serve the purpose? My time for microscopic work is limited. Would I be able to get satisfaction from an immersion lens, working one or two hours daily?—G. H. C.*

A low angle, dry 1-7 inch, or ⅛ inch objective would not be satisfactory in practice. A ⅙ inch, or ⅛ inch, immersion lens will give cleaner and brighter images and is to be preferred. Get an oil immersion objective. It will have a good working distance, and respond to a comparatively small movement of the collar. Such an objective is easier to master than a water immersion lens, and will give much better satisfaction in actual work.

PRACTICAL SUGGESTIONS.

By L. A. WILLSON,

CLEVELAND, OHIO.

An Evening With Mosses.—The other evening a scientific friend called to have me show him some mosses with my 'scope. He had twenty-five or thirty different species that he had gathered, named, and mounted. The mounting was quite unique. Spreading the plant without any mounting medium upon a glass slip, taking pains that all parts should be displayed, he covered with thin glass or mica and fastened the covers by pasting strips of paper at their margins. On these slips he wrote their generic and specific names. The specimens looked elegant either as opaque or as transparent objects.

Mounting of Mosses.—The method above described is a quick way but requires a great deal of patience to get the leaves spread out and the fructification displayed. As the tissue is a light cellular tissue with no vascular parts, I find that balsam, especially benzole balsam, is a suitable medium. To mount, use a shallow cell. Tease and soak the specimen well in alco-

hol, then soak in turpentine and mount in balsam immediately.

When mounting in balsam use a 7-8 circle or a rectangular cover. Be sure that the space to be covered is well filled with the mounting medium; too much is better than too little. It will frequently be necessary to hold the cover down until the balsam sets. Hold down in the center with a rubber tipped pencil, press out all air bubbles and take care that the balsam fills the space beneath the cover.

The leaves are of a beautiful refreshing green and the calyptræ or fruit capsules and the teeth of the peristome are instructive and beautiful objects.

As opaque objects they may be mounted in the same way by adding a dark back ground. A collection of mosses will furnish enough material to keep one busy all winter. Before mounting, read up Bryophyta in Bessy's Botany, Mosses in an Encyclopedia, in Carpenter on the Microscope, or consult some special work. In this way, a mastery of the subject can be attained together with a proper judgment as to what is to be seen and mounted. Carpenter recommends mounting them on wooden slides.

The Circulation of the Blood.—In a tumbler of Algæ, I noticed three or four objects about a quarter of an inch in size, moving vigorously about. Placing one in a shallow cell, filled with water and covered, I examined with an inch objective. I think it was some sort of aquatic larva. But what attracted my attention and filled me with delight was the beautiful display of the general circulation of the blood. On viewing with the quarter inch objective the Eliptic al Corpuscles were plainly and beautifully visible, the action of the heart was revealed and the circulation observed in every part of the body.

How to Spread Blood for Examination.—Select for a spreader a plain glass slip with a smooth and true edge. Place the drop of blood on a slide to the left of the center. Press the spreader tightly on the slide and draw it firmly to the right. For immediate examination place a thin cover over the center. The capillary attraction and the adhesive qualities of the blood will cement it quite securely. It can then be examined even with an immersion lens if care be taken to let none of the fluid run under the cover. For a permanent mount omit the cover,

let the slide thoroughly dry, on a turn-table, wipe off all the film except the circle to be covered, then stain and mount in balsam. The staining method of the late Dr. A. Y. Moore, described in THE MICROSCOPE some years ago is the quickest and best staining method I have ever used or seen described. It was accomplished by preparations of eosin and by that method blood with a nucleus could be easily double stained.

RECENT PUBLICATIONS.

The Pursuit of Happiness. By Daniel G. Brinton, LL. D. 12°, 292 pp. Phila., David McKay: 1893.

The anticipation awakened by the announcement of a book by Dr. Brinton is naturally great. He has been known for years as one of our most distinguished ethnologists. We expect therefore, something on happiness far above the ordinary—something scientific. And we get it. Happiness is defended as a legitimate pursuit and we are told how to attain it. We are not asked to be miserable now with great expectations for the distant future, but to be happy now as the condition for doing the most good. We are to seek such happiness even in food and drink. "In Paris where the art of cookery has its home and the Prohibition party no adherents, dispepsia is scarcely heard of, and the arrests for drunkenness during the year 1890 were only 38." To which the writer would add that during a four months residence in Paris, he never saw anybody refuse wine and he saw only two intoxicated persons, neither of whom was a Frenchman. Any one who has seen happiness in Paris can appreciate the philosophy of Dr. Brinton's splendid book.

Check List of the Plants of Kansas. By Bernard B. Smyth. Price 25 cents.

Copies can be obtained by addressing Mr. Smyth at Topeka, Kans. Nothing is included below the ferns and mosses. The list will be useful to botanist who make collections. Mr. Smyth offers collections for sale, 20 specimens for a dollar.

Bibliography of the Chinookan Languages. By J. C. Pilling. Bureau of Ethnology, Washington, pp 81. 1893.

This pamphlet deserves a notice on account of it containing the completest and most scientific illustration of the extended method of making bibliography yet published.

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1894.

During the coming year, the MICROSCOPE will continue and expand its popular features. People not accustomed to the use of these instruments will be able to appreciate pictures of invisible life. Arrangements have been made to illustrate each number in the style of the present issue. Dr. Shanks will continue the Replies to Queries, and each subscriber will be privileged to submit 10 questions. Mr. Willson will continue the Practical Suggestions. Dr. C. Q. Jackson of Pittsburg has accepted the Department of Science-Gossip. Whatever will tend to increase popular interest in the Microscope will receive our cordial support.

In order to enable our new subscribers to get back numbers, we have saved 50 sets of the New Series and will supply them as follows:

Nos. 1-12, (1893) $1.00.

Nos. 1-24, (1893 and 1894) $1.75.

Nos. 1-24, and a year of the Micro. Journal $3.25.

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